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DIRECTOR.

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## ADDENDA AND CORRIGENDA.

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Page 74, line 7.—For 3.4 read  $\frac{3}{4}$ .

.. 74 .. 33— .. 11 .. 1.1.

.. 75 .. 1— .. 1.2 ..  $\frac{1}{2}$ .

.. 75 .. 3— .. 1.3 ..  $\frac{1}{3}$ .

.. 75 .. 27— .. 1.2 ..  $\frac{1}{2}$ .

.. 221 .. 41— .. *parabolo* read *parabola*.

.. 225 .. 18 —Lieut -Colonel A. J. Peile has lately published (Proc. Malac. Soc., xv., 1922, p. 18, 19, fig. 1) a new figure of the radula of *Columbarium*. He withdraws this genus from the Turridae and refers it to the Rachiglossa near the Muricidae. He also unites *C. pagodoides* Watson to *C. spincincta* Watson.

.. 225 .. 37—The date of *Fusus pagodoides* is not 1881, but June 12th, 1882.

.. 231 .. 18—For XANTHOPLES read XANTHOPHAES.

.. 239 .. 15—For *Pleurotoma* read *Drillia*.

.. 244 .. Delete lines 8 to 10. This figure is from the type.

.. 249 .. 27 and 28 —For SUBLICATA read SUBPLICATA.

.. 255 .. 22 —For *Strombus* read *Strombus lividus*.

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## MINERALOGICAL NOTES: No. X.

BY

C. ANDERSON, M.A., D.Sc., Mineralogist, Australian Museum.

(Plates i.-viii.).

BERYL.

Torrington, N.S.Wales.

(Pls. i., ii.)

Beryl is a fairly common mineral in the granite area of New England, occurring both *in situ* and, more frequently, as rolled crystals and fragments in alluvial deposits. Fine crystals, some of considerable size, have been found in the Torrington district, and in a previous paper<sup>1</sup> crystals from Heffernan's Mine in this locality have been described and figured. The crystals measured up to  $6 \times 5$  cm. and were very simple consisting merely of the prism *m* (1010) and the base (0001): recently choice crystals of greater complexity have been obtained from this mine and others in the vicinity, and are here described. An interesting feature of some of the crystals is the curious markings they exhibit, particularly on the basal plane. The zonal and parallel growth shown by many of them is also instructive and may afford a clue to the conditions under which they were formed.

*Occurrence and Associates*:—According to Mr. J. E. Carne<sup>2</sup>, Government Geologist, the beryl at Heffernan's Mine is found in a soft, decomposed, micaceous rock where it occupies vugs containing also quartz, felspar and mica. A specimen in the Australian Museum collection, coming however from another mine in the neighbourhood, consists of a mass of fractured and opaque beryl embedded in black mica. Many of the larger crystals from Heffernan's contain dark inclusions, the nature of which could not be determined, and in one a fragment of smoky quartz is embedded, indicating that quartz probably preceded beryl; some of the beryls are invested, particularly on the base, by a closely adhering skin of silvery mica.

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<sup>1</sup> Anderson—Rec. Austr. Mus., vii., 1908, pp. 62-63.

<sup>2</sup> Carne—Dept. Mines N.S.Wales: Min. Resources, No. 15, 1912, pp. 58, 93.

Mr. Charles Bogenrieder, Mining Engineer, who visited Heffernan's Mine at the time when the beryl crystals were being obtained (the mine is now closed), and was, I believe, the first to correctly identify the mineral, has favoured me with the following account of its mode of occurrence:—"While inspecting Heffernan's mine in 1908 for the purpose of seeing whether the then owners of the property would be able to produce a steady supply of wolfram, the writer was shown a small heap of green crystals of beryl, which the miners thought to be either fluorspar or some variety of quartz, the latter opinion being suggested by the fact that some of the crystals were intergrown with quartz matrix and white or smoky crystals of quartz. In a trench about a hundred feet long and four to eight feet deep the writer was able to secure a number of loose crystals of beryl of beautiful colour and transparency. These crystals were found embedded in a clayey stratum not more than two or three feet from the surface, and were accompanied by a number of druses of smoky quartz, which showed decided zonal growth, the outer layers being progressively darker than the kernel. A foot or two deeper, still in the clayey stratum, were found nodules of wolfram ore, occurring in rich patches and bunches and constituting a friable mass, with here and there well defined crystals of wolframite. Some of these lumps weighed twenty to thirty pounds carrying sixty to seventy per cent. of wolframite. On returning to Sydney the writer presented some of the beryls to the Australian Museum and others to Mr. Percy Marks, Jeweller, who later obtained a considerable quantity of these fine crystals and exhibited them at the Paris Exposition of 1910."

*Elements.*—Nine crystals were measured on a two-circle goniometer; of these four gave excellent signals and the angles obtained from them were utilised to determine the axial ratio. The data and results are tabulated below.

Form.	$\rho$	Limits.	No. of Obs.	$c$
$p$ 1011	29 58½	29 57 30 7	15	.49949
$u$ 2021	49 5½	49 3 49 6	9	.49968
$s$ 1121	44 57½	44 56 44 58	9	.49924

Weighting these results according to number of observations we obtain for  $c$  the value .49947, as compared with Koksharov's ratio .49885.

*Forms and Angles.*—Eleven forms, of which two,  $\theta$  (3031) and the new form (9092), are probably preresion faces were identified; these are tabulated along with the measured angles and those calculated from the axial ratio as given above.



Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
<i>c</i> 0001	—	—	—	—
<i>a</i> 1120	30 0	90 1	30 0	90 0
<i>m</i> 1010	0 0	90 0	0 0	90 0
<i>p</i> 1011	0 0	29 58	0 0	29 58
<i>u</i> 2021	0 0	49 5	0 0	49 5
$\theta$ 3031	(0 0)	59 55	0 0	59 58
9092*	(0 0)	68 51	0 0	68 56
<i>s</i> 1121	30 0	44 57	30 0	44 58
<i>v</i> 2131	19 5	56 45	19 6	56 46
<i>z</i> 4263	19 6	45 30	19 6	45 29
<i>n</i> 3141	14 8	64 36	13 54	64 19

*Combinations.*—The subjoined table shows the distribution of the forms on the nine crystals; it will be noticed that the most common forms are *c* (0001), *m* (1010), *p* (1011), *u* (2021), *s* 1121).

Cryst.	<i>c</i> 0001	<i>a</i> 1120	<i>m</i> 1010	<i>p</i> 1011	<i>u</i> 2021	$\theta$ 3031	new. 9092	<i>s</i> 1121	<i>v</i> 2131	<i>z</i> 4263	<i>n</i> 3141
I.	✓	×	✓	✓	×		×	✓	✓		
II.	✓		✓	✓	×		×	×			
III.	✓	✓	✓	✓	×	✓		✓			
IV.	✓		✓	✓	×			×			
V.	✓		✓	✓	×			✓			
VI.	✓	✓	✓	✓	✓			✓			
VII.	×	✓	✓	✓	✓			✓			
VIII.	×	×	✓	✓	×			✓			
X.	✓	✓	✓	✓							

*Description of Crystals.*—The crystals have the usual beryl habit, long prismatic with well developed base and *m* prism, narrow planes of *a* and small pyramidal faces.

Crystal i. (Pl. i., figs. 1, 2) measures  $3 \times 1.5$  cm. In colour it is an aquamarine of good quality but much flawed internally. The prisms are strongly striated vertically but the base is perfectly smooth and devoid of markings. The principal faces are  $c$  (0001),  $a$  (1120),  $m$  (1010),  $p$  (1011), and  $u$  (2021); two small faces of  $c$  (2131) are present. Between the prisms and pyramids there is a narrow etched band shown in the figure as a stippled area; reflections were obtained from this band, the angle  $\rho$  varying from  $68^\circ 15'$  to  $69^\circ 26'$  with a mean of  $68^\circ 55'$ . This indicates a form (9092), hitherto undescribed, for which the calculated value of  $\rho$  is  $68^\circ 56'$ . As this is clearly a prerosion face, I have not assigned a letter to it.

Crystal ii. is essentially similar to No. i. but it is much smaller, measuring  $1.4 \times .6$  cm., and almost colourless. It shows nearly the same combination with the absence, however, of  $a$  and  $c$ ;  $u$  is relatively narrow. There is the same etched zone between the prisms and pyramids and the average reading for the reflection obtained gave an angle  $\rho$  of  $68^\circ 47'$  which agrees well enough with that obtained in crystal i. and the calculated angle for (9092).

Crystal iii. resembles Nos. i. and ii. but here the prerosion form seems to be  $\theta$  (3031) for the average value for  $\rho$  is  $59^\circ 53'$  (calculated  $59^\circ 59'$ ).

Crystal iv. measures  $1.1 \times .5$  cm. It has the usual etched zone between pyramids and prisms and the pyramids themselves are slightly attacked.

In Crystal v., which measures  $1.4 \times .7$  cm., the etching has almost obliterated the small faces of  $p$ ,  $u$ , and  $s$ , replacing them by a rough surface from which no distinct reflections could be obtained. The base is slightly attacked and shows a number of lines and roughly hexagonal markings, mainly depressions, the lines and boundaries running parallel to the edge  $c/p$ . The prism faces show markings which are oblong or irregular elevations and depressions, the long directions of which are parallel to the vertical axis.

Crystal vi. (Pl. i., fig. 4) from Hefferman's mine, measures  $3 \times 1.9$  cm.; only the termination is shown in the figure. The etching is here in the early stages and consists of a band between the prisms and pyramids which is pitted and rough but exhibits no definite figures and yields no satisfactory reflections. The base is large and diversified by a number of lines and hexagonal markings as indicated in the figure, the directions of the lines and the boundaries of the markings being that of the edge between  $c$  and  $p$ . Under the microscope the markings reveal themselves as slightly raised portions of the base bounded by narrow planes of  $p$ . The crystal is composed of two or possibly three portions not quite in parallel position and shows a number of growth zones consisting of successive hexagonal shells, the outer shells being partly stripped off. Three small planes of  $u$  (3111) were identified on this crystal, this being the only instance of their occurrence on the Torrington beryl.

Crystal vii. (Pl. i., fig. 6), also from Heffernan's Mine, is similar to the preceding but the markings on the base are more pronounced and the pyramid faces are almost obliterated. The narrow  $\rho$  faces bounding the elevations on the base are seen in the goniometer telescope as a series of bright, parallel lines.

Crystal viii. (Pl. i., figs. 7, 8, Pl. ii., fig. 7) is the property of Mr. George Smith, Inspector of Mines, who kindly lent it for description. It is believed to be the finest crystal obtained from Heffernan's Mine. It measures  $4.5 \times 4.8 \times 3.5$  cm. and is bluish green in colour with numerous internal flaws. In the line drawings the faces are shown without markings, the photograph (Pl. ii., fig. 7) gives a good idea of the basal plane as it really is. To obtain this photograph the crystal was blackened underneath and on the sides and the base coloured a slaty tint with a mixture of lamp black and Chinese white; the result surpassed anticipation. The faces of the prisms are striated vertically and the pyramids are much corroded. The base is traversed by a series of "gullies" which zigzag across the face; the general direction of these gullies seems quite arbitrary in cases, but closer inspection shows that they are made up of short lengths which run parallel to the intersections  $c/\rho$ ; they are flanked by planes of  $\rho$ . In addition to the gullies there are a number of hexagonal elevations, especially in the central depressed portion of the base. These elevations are bounded by faces of the base and the pyramids  $\rho$  and, less frequently,  $u$  and  $s$  in addition. The main basal surface is covered with thin plates, some regularly hexagonal in outline, others irregular in shape, but all with straight boundaries parallel to the edge  $c/\rho$ , and having edges formed by narrow faces of  $\rho$ . These plates are perhaps the result of oscillatory combination between  $c$  and  $\rho$ . If one imagines the gullies filled in, the base of the crystal would then resemble that of crystal vii.

Crystal ix. (Pl. ii., fig. 6), which comes from Heffernan's, presents a striking and puzzling appearance. The photograph represents the termination of a crystal measuring 4.5 cm. in greatest diameter. Round the edges of the base we find a succession of terraces which would seem to indicate that the basal surface has been progressively stripped off, and the whole base is intersected by a series of broad "valleys" separating numerous hillocks. It is difficult to avoid using the language of physiography in describing this crystal for it strongly resembles an island of horizontally bedded rocks which is being terraced by the sea, and the surface of which has been carved into a network of gorges and flat bottomed valleys, trending roughly parallel to the prism faces which form the coast line, and separated by numerous residuals and mesas and occasional sharp pinnacles. The mesas are margined by faces of  $\rho$  (1011) and more rarely  $u$  (2021), which are sometimes pitted and partly eaten into by flutings which run parallel to the vertical axis and deeply score the bounding prism faces of the crystal.

Apart from the large scale features the basal surfaces are in places covered with small pits, some distinctly hexagonal, others apparently circular. On the faces of the unit pyramid bounding residuals a few etch

figures can be observed; these are very small but seem to be isosceles triangles with the obtuse angle, which is not much greater than  $90^\circ$ , directed upwards, and the base parallel to the edge 0001/1011.

The crystal presents essentially the same features as No. viii., and whatever the explanation of these curious features may be it must be applicable to both crystals.

Crystal x. (Pl. i., fig. 3), Heffernan's Mine, is drawn with a face of  $p$  (1011) polar so as to show the structures exhibited by the base to advantage. The sketch represents part of the termination of a crystal of 1.5 cm. in greatest diameter; for the sake of clearness many details are omitted. It will be observed that the upper surface consists of a succession of terraces which are portions of the basal plane bounded by approximately perpendicular, deeply fluted walls, with occasional planes of  $p$  intervening. The base shows numerous hexagonal markings consisting of thin plates bounded by faces of  $p$ , as in crystals vi. and vii.; indeed if the residuals were removed and the whole surface of the lowest terrace revealed, or if the "landscape" were restored up to the level of the highest terrace, the base would then present an appearance similar in all essentials to that of Nos. vi. and vii. A number of horizontal lines will be observed on the prism faces; these are the outcrops of planes parallel to the base which are present in most of the crystals, most markedly near the terminations, and which, in some cases at least, are continuous across the width of the crystals. Whether these are cleavage planes or planes of growth they probably determine the positions of the successive terraces.

Crystal xi., from Heffernan's, measures  $5.5 \times 3.5$  cm. and is of a bluish-green colour. It consists simply of base and unit prism. The base is terraced slightly and trenched, but not deeply, and the residuals have quite irregular boundaries. Small hexagonal pits appear on the smooth portions of the basal surface. A small quartz crystal projects obliquely from the base; the prism faces of the quartz are fresh but the rhombohedral faces are corroded. At one part along the periphery of the beryl the top layers have been removed, producing a narrow ledge bounded on the inner side by a steep, in parts even overhanging, cliff, slightly embayed. The floor of this ledge is composed of the much corroded base and remnants of the pyramids  $p$  and  $u$ . It is to be noted that in this specimen, as in all the others, wherever a residual has vertical, or almost vertical, walls bounding it, these are quite rough and irregular, and are not the faces of prisms; whenever a residual has straight boundaries these are the intersections of base and pyramid.

Crystal xii. (Pl. ii., figs. 4, 5) also comes from Heffernan's Mine. This fine crystal measures  $5.5 \times 4.5$  cm. and is light green in colour with a yellowish tinge. The only forms identifiable by inspection are  $c$  (0001),  $a$  (1120) and  $m$  (1010). The prism faces are striated vertically, and in one place the outer prism layer has been removed to a depth of .3 cm. revealing a new surface underneath; between the two layers is a thin selva of clay, a common feature in zoned crystals from Heffernan's Mine. Probably this clayey layer is not an original inclusion but has been subsequently squeezed in between the growth shells.

The base here presents an appearance quite unlike that of the foregoing specimens. It shows numerous hexagonal pits oriented with their boundaries parallel to the edges  $c/p$  and running into one another to form approximately rectilinear depressions traversing the basal surface with a general trend parallel to these edges. Some of the pits are .3 mm. in diameter, and some are so small as to be just visible under high magnification; the smallest pits seem circular when examined by a lens, but under the microscope they are seen to be bounded by straight edges and to have the usual hexagonal form. No dihexagonal pits are recognisable. The pits descend by steps to the bottom which is generally formed by the basal plane; this may be in its turn pitted in the same manner, but on a smaller scale, so that we have pits within pits. In other cases the pits terminate downwards in a point. The walls of the pits are sloping and though somewhat striated they reflect light fairly well. A sulphur cast of part of the base was made with excellent results, and goniometric measurement proved that the walls of the pits are formed by faces of the first order pyramid  $p$  (1011); the angle  $\rho$  averages  $29^\circ 51'$ , calculated  $29^\circ 58'$ . The marginal portions of the crystal are terraced as indicated by the irregular wavy lines resembling contour lines, this effect being apparently a result of the zonal growth, thin shells being stripped off in succession.

The pits on the base are quite similar to previously described natural and artificial etch figures<sup>3</sup>, and there is no doubt but that they are the result of the action of some solvent. As the etch pits are bounded by faces of  $p$  (1011) we may conclude that these planes are produced by the process of etching.

Crystal xiii. (Pl. ii., fig. 2) is a short section of a prism measuring 3 cm. in diameter. It is photographed as a transparency to show the zoned structure and illustrates the common feature that the nucleus and central portions of the crystal are more complex than the exterior layers.

Crystal xiv. (Pl. i., fig. 5), from Heffernan's Mine, is a composite crystal consisting of four portions in parallel position; the whole measures  $5 \times 3$  cm. The terminations have been corroded and rounded so that no faces are now distinguishable except small areas of the base. It is probable that the whole crystal has been reduced in length as the result of corrosion, and the components of least diameter have been reduced most, as one should expect.

Crystal xv. (Pl. ii., fig. 1) has evidently been strongly etched so that the termination is now reduced to a series of sharp, irregularly distributed pinnacles; the prism too has been attacked and eaten into by the solvent. This specimen has considerable resemblance to that figured by Lacroix<sup>4</sup>, who attributes the peculiar appearance to corrosion.

<sup>3</sup> Traube—Neues Jahrb. Min., Beil.-Bd. x., 1896, pp. 464-468; Kohlmann—*Ib.*, Beil.-Bd. xxv., 1907, pp. 173-174; Honess—Amer. Journ. Sci., xlii., 1917, pp. 223-236.

<sup>4</sup> Lacroix—Minéralogie de la France, ii., 1897, fig. 2, p. 11.

Pentfield<sup>5</sup> has described a similar feature in the case of the beryl of Mt. Antero, California, and ascribes the formation of certain very steep pyramids to solvent action. He was able to identify one of the pyramids as the form (36:24:60.5): in the case of the Torrington beryl no planes are recognisable.

*Interpretation of the Markings on the Base.*—Regular markings, whether pits or hillocks, on the faces of crystals may be caused by solution, or may be growth features, and it is not always easy to decide to which of these the markings are to be attributed in particular cases. Professor V. Goldschmidt, who has had much experience in this branch of crystallography, says<sup>6</sup>:—"Oft ist es schwer, manchmal unmöglich, Lösungsfiguren und Wachstumsfiguren zu unterscheiden. Es wird unsere Aufgabe sein Kriterien zu deren Unterscheidung festzulegen. So lange wir nicht für die einzelne Figur entscheiden können, betrachten wir derlei Gebilde als Lösungsfiguren, wenn ihre Gesamtheit darauf schliessen lässt, dass die Bildungsgeschichte des vorliegenden Krystalls mit Lösung abgeschlossen hat, umgekehrt als Wachstumsfiguren, wenn wir aus allen Anzeichen schliessen können, dass sie mit Wachsen abgeschlossen hat."

In the case of the Torrington beryl, crystal xii. (Pl. ii., figs. 4, 5) has clearly been etched by some solvent. The pits are precisely similar to the artificial etch figures which can be developed on the base when the crystal is immersed in fused caustic soda for example. It is also pretty certain that crystals xiv. and xv. have undergone considerable solution, and indeed represent a late stage in the process; in fact, we may fairly conclude that the closing chapter in the history of these crystals was one in which solution played a leading role, which *prima facie* would indicate that the peculiar features of crystals viii.-xi. are also the result of solution. Again, the narrow band shown between the pyramids and prisms in crystal No. i. (Pl. i., figs. 1, 2) is undoubtedly etched, and the fact that in crystal v. the pyramid faces have been almost obliterated indicates that the etching is progressive. It is in accordance with theory that dissolution should be most active along prominent edges, and that these should be first attacked. While it is clear that solution has taken place in these crystals I hesitate to state dogmatically that crystals viii., ix., x., and xi. owe their striking appearance to a process of etching, and must leave the decision to those who have more experience of crystal solution and growth. I shall content myself with stating the facts and indicating possible deductions therefrom.

In these crystals the pyramidal faces which bound the hillocks are smooth and brilliant, with little or no suggestion of the curvature and striation which we associate with solution faces; moreover, in etching experiments it has been found that the figure faces usually have high indices and are indeed vicinal in character. Yet regarding crystal No. viii. (Pl. ii., fig. 7) one can scarcely resist the conclusion that the gullies and pits which now diversify its surface are secondary, and, if that

<sup>5</sup> Pentfield—Amer. Journ. Sci., xl., 1890, pp. 488-490.

<sup>6</sup> Goldschmidt—Zeits. Kryst., xl., 4, 1905, p. 379.

is so, to what cause can we attribute their formation if not to solution? An alternative hypothesis is that the faces of  $c$  (0001) and  $\rho$  (1011) occurring at different levels in this crystal and Nos. ix.-xi. pre-existed, and are revealed when the overlying layers are dissolved away; that is, they result from zonal growth. To test this hypothesis I made several attempts to produce such an underlying surface by splitting the crystals in a direction parallel to the basal plane, but in no case did I succeed in obtaining a surface with well formed faces of  $c$  and  $\rho$ , even when there was strong evidence that a pronounced structure plane extended across the crystal in this direction; the fracture was invariably rough or subconchoidal. A second hypothesis which might be put forward is that these crystals consist of a number of sub-individuals in parallel position in which zonal structure is strongly developed, and the hexagonal hillocks are really forms of accretion which are now being dissolved mainly in a lateral direction, giving rise to concentric hexagonal markings and elevations. But it is difficult to imagine that an appearance such as that presented by crystal No. x. (Pl. i., fig. 3) could be thus produced.

If we assume that the pits and hillocks on these crystals result from solution, not from growth, we have to find a plausible explanation of the fact that the etch figures are in general so large, so well defined, and bounded by true, not vicinal faces, as we should expect. Our knowledge of etch figures is now extensive, but much of it has been obtained by study of the results of artificial etching, and it is possible that natural etch figures, which are in most cases produced by the long continued action of very dilute solvents, may present features which cannot be reproduced in the laboratory, where solvent action is, as a rule, rapid. One of the latest writers on etch figures<sup>7</sup> holds that the point of origin and the distribution of etch figures on a crystal face have a close relation to the molecular structure, that, in fact, faces and directions of maximum cohesion are attacked much more slowly than those in which the cohesion is of a lower degree. This is in accordance with the observed fact, well illustrated in these beryl crystals (Pl. ii., figs. 4, 6, 7), that the pits are disposed in more or less straight lines which are presumably lines of weak cohesion. The occurrence of stepped pits and stepped hillocks, which are characteristic of the crystals, is readily explicable on this theory, as the terracing is determined by the presence of cleavage planes and possibly also by zonal growth planes.

As regards the figure faces, McNairn has found that these are not truly curved, but are made up of a large series of small planes inclined at low angles to one another, and that they represent as close an approximation to true crystal faces as is possible under the circumstances<sup>8</sup>. Following Goldschmidt, he considers that "in pit formation there are two opposing tendencies, one of which would result in the formation of round excavations if unopposed, and the other in the development of true crystal faces. Thus the net result is these faces

<sup>7</sup> McNairn—*Trans. Roy. Canad. Inst.*, xi., 2, 1917, pp. 229-267.

<sup>8</sup> McNairn—*Loc. cit.*, p. 258.

which are approximately regular, and hence are of value in the determination of the physical properties of crystals<sup>9</sup>. It is conceivable that under certain conditions, perhaps not realisable in laboratory experiments, the second tendency may preponderate, and etching may result in the production of true crystal faces and these of common occurrence; in fact, that solution may be simply a reversal of growth and produce the same faces. In a review of the publications dealing with natural etch figures on beryl it is observed that several crystallographers have identified certain of the figure faces as belonging to common forms. Thus Penfield<sup>10</sup> enumerates the following forms on the beryl of Willimantic, Connecticut, as having been developed by etching, namely, (4261), (2131), (3141), (10 $\bar{1}$ 1). Vrba<sup>11</sup> determined the faces on etch figures of beryl from Pisek and found such forms as (11 $\bar{2}$ 2), (3032), (2021). Kohlmann<sup>12</sup> identified on the etch figures on the base of Brazilian beryl the forms (1011), (3031), (3·3·6·10), (3 3 6 4), (1121). Thus it is not inconceivable that etching may have led to the production of common forms on the Torrington beryl also, but, if this be so, it is necessary to assume that subsequent to their formation another type of dissolution supervened, resulting in the gradual destruction of the faces and the production of a mutilated crystal such as No. xv. (Pl. ii., fig. 1).

In the faint hope that some information of value might be obtained Crystal vii. (Pl. i., fig. 6) was etched in stages; the reagent used was fused caustic soda. Two minutes immersion produced no visible effect, but after five minutes the basal plane became pitted all over with minute, apparently circular, depressions. The preexisting markings were not accentuated in any discernible degree, but the corrosion of the edges bounding the base was increased and the pyramid faces had almost disappeared. After a second immersion of ten minutes the etch pits were distinctly hexagonal and beautifully sharp, the edges of the hexagons running parallel to the edge *c/p*. No figure faces could be as yet distinguished on the pits. The crystal was then submitted to the action of the reagent for fifteen minutes, resulting in an enlargement of the pits, some of which now showed distinct pyramidal faces. In most cases the pits terminated below in a flat expanse of the basal plane, in others they descended by steps to a point. The angles of the hexagons seemed slightly rounded, but, generally speaking, the pits were quite comparable, except in size, with the natural pits on crystal xii. (Pl. ii., figs. 4, 5). The bounding pyramidal planes of the crystal had quite disappeared. On certain portions of the base were series of pits linearly arranged and overlapping. Here and there were observed residuals in the form of narrow, flat-topped ridges. These, on being inspected by hand lens and microscope, were seen to have an irregular wavy, almost conchoidal surface. The crystal was now mounted on the goniometer

<sup>9</sup> McNairn—*Loc. cit.*, p. 258.

<sup>10</sup> Penfield—*Amer. Journ. Sci.*, xl., 1890, p. 490.

<sup>11</sup> Vrba—*Zeits. Kryst.*, xxiv., 1895, pp. 101-112.

<sup>12</sup> Kohlmann—*Neues Jahrb. Min., Geol.-Bot.*, xxv., 1907, p. 174.



but it was found that the figure faces were too small to yield any reflection. Another immersion of twenty minutes resulted in but slight change, although the residuals were reduced in area. The crystal was then acted on for thirty minutes with the disappointing result that all regularity was destroyed, the markings being now conchoidal, resembling thumb markings, and quite devoid of symmetry. It was observed that certain depressions running in irregular directions had been developed.

*Optical Characters.*—In a section cut parallel to the base of a crystal from Heffernan's Mine there is a central core which is dark between crossed nicols in parallel polarised light; this is surrounded by a striated zone, the striae parallel to the faces *a* and *m* and consisting of thin doubly refracting lamellae alternating with thicker bands of uniaxial material. These thin lamellae do not extinguish simultaneously, but each parallel set has straight extinction. In convergent light the interference figure is distorted, mainly uniaxial, although the cross opens out sensibly in certain areas, particularly in the striated peripheral layers. These observations are in substantial agreement with those of Bertrand<sup>13</sup> and Kohlmann<sup>14</sup> on Muzo and Brazilian beryl respectively.

The indices of refraction for sodium light were determined by the method of minimum deviation, two alternate faces of *m* forming the refracting prism. As might be expected from the lack of optical homogeneity disclosed by a basal section the signals were not very sharp, but concordant results were obtained in four independent measurements, as set forth in the following table:—

T <sub>1</sub>	T <sub>1</sub> '	T <sub>2</sub>	T <sub>2</sub> '	δ <sub>1</sub>	δ <sub>2</sub>	ε	ω
66 33	109 26	...	...	42 53	...	1.5640	
...	...	65 32	108 48	...	43 16	...	1.5681
66 37	109 27	...	...	42 50	...	1.5634	
...	...	67 6	110 23	...	43 17	...	1.5683
287 57	245 4	...	...	42 53	...	1.5640	
...	...	288 40	245 21	...	43 19	...	1.5686
288 24	245 28	...	...	42 56	...	1.5645	
...	...	288 0	244 38	...	43 22	...	1.5692

The average of these measurements gives  $\epsilon = 1.5640$ ,  $\omega = 1.5685$ ; thus the birefringence = .0045. Compared with previous determinations these values are inclined to be low, and accepting Ford's generalisation<sup>15</sup>

<sup>13</sup> Bertrand—Bull. Soc. Fr. Min., ii., 1879, p. 31.

<sup>14</sup> Kohlmann—Neues Jahrb. Min., Beil.-Bl. xxv., 1907, p. 179.

<sup>15</sup> Ford—Amer. Journ. Sci., xxx., 1910, pp. 128-130.

that an increase in the amount of alkalis, especially caesium, contained is accompanied by a rise in specific gravity, in refractive indices and birefringence we should expect the Torrington beryl to contain a low percentage of alkalis and to have a low specific gravity. As will be seen presently this expectation is fulfilled.

*Composition and Specific Gravity.*—Two analyses of Torrington beryl, probably from Heffernan's Mine, have been made by Mr. J. C. H. Mingaye<sup>16</sup> with the following results:—

		I.		II.
Si O <sub>2</sub>	...	66.08	...	64.70
Al <sub>2</sub> O <sub>3</sub>	...	19.86	...	22.22
Be O	...	12.96	...	11.84
Fe O	...	0.30	...	0.37
Mn O	...	tr.	...	tr.
Ca O	...	abs.	...	abs.
Mg O	...	"	...	0.04
Na <sub>2</sub> O	...	0.43	...	0.24
K <sub>2</sub> O	...	abs.	...	0.13
Li <sub>2</sub> O	...	pres.	...	pres.
H <sub>2</sub> O	...	0.58	...	0.60
P <sub>2</sub> O <sub>5</sub>	...	abs.	...	abs.
Cr <sub>2</sub> O <sub>3</sub>	...	"	...	"
V <sub>2</sub> O <sub>5</sub>	...	"	...	"
		100.21		100.14
S. G.	...	2.661		2.666

*Analyst's Note.*—Caesium, if present, is in very small amount; strong spectroscopic reaction for lithium and strontium.

The specific gravity of the crystal from which the section was cut for optical examination was determined; the fragment weighed 3.1679 grains and its specific gravity, found by the ordinary weighing method, is 2.664.

*Paragenesis.*—From a study of hand specimens and the observations made at Heffernan's Mine, and the Torrington district generally, by Carne, Andrews, and Bogenrieder, it is clear that the beryl was formed in a pegmatitic phase of a granitic rock. Mr. Carne<sup>17</sup> who has made a careful study of the ore occurrences at Torrington, is of opinion that the ore rock, which contains wolfram, quartz, felspar, mica, beryl, and topaz, is the latest phase of granitic intrusion into the sedimentary rocks. It is conceivable that there were successive invasions by mineralising vapours from the cooling magma as this would perhaps account for the marked zonal structure of the quartz and beryl crystals. Constructive pneumatolysis was followed by *destructive* pneumatolysis, the evidence for which is seen in the etching of the quartz and beryl and in the accumulation of what Mr. Carne calls decomposed micaceous rock and

<sup>16</sup> Mingaye—Ann. Rept. Dept. Mines N.S.Wales, 1915 (1916), p. 198.

<sup>17</sup> Carne—Dept. Mines, N.S.Wales: Min. Res., No. 15, 1912, p. 49.

Mr. Bogenrieder a stratum of clay, for this may fairly be regarded as the insoluble, more or less amorphous residue resulting from the destruction of the felspars, and the beryl crystals, quartz druses, and lumps of wolfram thus set free are now found embedded in this clayey matrix, the wolfram, as might be expected from its greater density, at a lower level than the beryl and quartz.

As to the agent or agents which have been responsible for this series of events we are more or less in the dark; in spite of the presence of topaz fluorine was probably not the etching medium, for beryl is but slightly affected by hydrofluoric acid. It is possible that some alkaline solution, such as carbonate of potash, which at a high temperature is a solvent of most silicates, may be responsible; carbonic acid is now regarded by some authorities as the active agent in the kaolinisation of felspars<sup>18</sup>, and, as McLintock and Hall<sup>19</sup> have suggested, the alkaline carbonates thus set free would attack the other silicates, such as quartz, beryl, or topaz.

#### CALCITE.

Belubula Caves, near Mandurama, N.S.Wales.

(Pl. iii., figs. 1, 2; Pl. iv.)

The Belubula Caves are in Parish Malongulli, County Bathurst, about fifteen miles west from Mandurama, and two miles north of the main road from Carcoar to Canowindra. They were discovered by a man named Rittmeister, who, when kangaroo hunting, rested near the spot one winter's morning and observed steam rising from a huge cleft in the limestone. Later, with some companions, he explored the caves, descending to a depth of nearly eight hundred feet at a distance of about a mile from the entrance, finding corridors and chambers interminable. It was discovered later that this was only one of a series of caves, and no fewer than six entrances were found at different parts of the same hill. The caves were subsequently explored and described by the late C. S. Wilkinson, Government Geologist<sup>20</sup>, and O. Trickett<sup>21</sup>.

In 1917, I was privileged to pay a short visit to the neighbourhood and to explore part of the caves, particularly the chamber where the crystals occur, under the expert guidance of Mr. W. F. Hosie, Miss Judy Hosie, and Mr. W. F. Harris; without the help of these my visit would have been practically without result, and my best thanks are due to them for their cordial assistance.

The cavern in which the calcite crystals described in this paper were discovered is reached by an opening on the slope of a limestone ridge, situated about half a mile to the north of the Belubula River, and rising about three hundred feet above the river bed. The crystal chamber is

<sup>18</sup> Butler—*Min. Mag.*, xv., 1908, pp. 128-146.

<sup>19</sup> McLintock and Hall—*Ibid.*, xvi., 1912, p. 301.

<sup>20</sup> Wilkinson—*Rec. Geol. Surv. N.S.Wales*, iii., 1892, pp. 1, 5.

<sup>21</sup> Trickett—*Ann. Rept. Dept. Mines N.S.Wales*, 1908 (1909), p. 172.

reached after traversing a number of galleries and corridors to a depth of approximately three hundred feet for a distance of about eighteen chains. Across one corner of this chamber is an overhanging ledge draped with a curtain of stalactite growth and forming a sort of shelf about ten feet above the floor of the cavern; it was in this ledge that the crystals were discovered by Mr. W. F. Hosie, of Carlton, a station property in the vicinity. When the ledge was broken into from above a lense shaped opening, measuring approximately eight feet long, four feet wide, and eighteen inches high was revealed, the bottom, roof, and sides of which were studded with beautiful groups and single crystals of transparent or translucent calcite; the largest crystals, some of them eight inches in length, are clustered round the edges where the roof and floor of the cavity meet. The cavity has been broken into at both ends, and when it is illumined from one end and viewed through the other opening it presents an aspect of rare beauty.

Probably the solution from which the crystals were deposited formed at one time a quiet pool in what was then the floor of the cavern. Usually the water in limestone caves is in constant circulation, a stream flowing along the floor, and the roof and walls continually dripping with the lime-bearing solution from which the stalactites and stalagmites are formed, but these crystals could not have been deposited under such conditions. Probably the pool in which they developed was a kind of backwater, perhaps formed by the accumulation of the clayey residue of the dissolved limestone which seems to have been highly argillaceous. This pool became crusted over with a crystalline deposit which now forms the roof of the vugh and is about five inches thick. The carbonic anhydride would then escape very slowly from the saturated solution which would remain more or less constant in temperature, and the conditions generally would be favourable for the growth of well formed crystals. That the conditions were uniform throughout the period of formation of the crystals is indicated by their striking uniformity of habit.

The crystals are relatively simple, the forms represented being  $a$  (1120),  $m$  (1010),  $r$  (1011),  $M$  (4041), and  $f$  (0221); of these  $M$  and  $f$  predominate and give the crystals their characteristic pointed shape (Pl. iii., figs. 1, 2; Pl. iv., fig. 5). The prism  $m$  and the rhombohedron  $r$  appear as narrow planes and are absent on many of the crystals. The second order prism  $a$  is usually present as a rounded face, convex or concave, giving on the goniometer a train of signals lying in the zone  $[a\ r]$ , the face being striated parallel to this zone axis (Pl. iii., fig. 2; Pl. iv., fig. 5). In the beautiful groups shown in Pl. iv., figs. 2, 4, some of the crystals look like simple rhombohedra through the predominance of  $f$ , although  $M$  is also present as small triangular planes. The faces of  $M$  are smooth and brilliant but  $f$  is frequently rounded and imperfect, with triangular etch pits, the edges of which are parallel to the intersections of  $f$  with  $m$ ,  $f'$  and  $f''$  (Pl. iii., fig. 1) or irregular markings (Pl. iii., fig. 2). The crystals have usually one good termination, the other, which was the point of attachment, being broken and irregular.

The following angular measurements were obtained from four crystals:—

Form.		Measured.		Calculated.	
Goldschmidt	Dana	$\phi$	$\rho$	$\phi$	$\rho$
<i>b</i> 1120	<i>m</i> 1010	29 37	89 48	30 0	90 0
<i>a</i> 1010	<i>a</i> 1120	0 45	87 4	0 0	90 0
<i>p</i> 1121	<i>r</i> 1011	30 0	44 37	30 0	44 36
<i>m</i> 4481	<i>M</i> 4041	30 0	75 46	30 0	75 47
$\phi$ 2241	<i>f</i> 0221	30 0	63 8	30 0	63 7

Near Glen Innes, N.S.Wales.

(Pl. iii., fig. 3.)

A small but very attractive specimen of crystallised calcite was obtained in a vugh during the sinking of a well through basalt. The crystals are brilliant, of a pale wine-yellow colour, and are seated on a base of chabazite crystals (Pl. v., fig. 1). The calcite crystals, which are never doubly terminated, measure up to about 1 cm. in length, and are constant in habit. Of the forms present *M* (4041) has very small faces, or may be absent altogether; the faces of *r* (1011) are brilliant and give flawless signals, but *a* (1120) tapers and is striated parallel to its intersections with *r*. The curious lozenge-shaped surface with triangular markings does not give a sharp reflection,  $\rho$  varying from  $66^{\circ} 44'$  to  $67^{\circ} 5'$ ; this would indicate Goldschmidt's *k* ( $5\cdot5\cdot10\cdot2$ ), corresponding to Dana's *g* (0552), but the face is more likely to belong to Goldschmidt's  $\phi$  (2241) = Dana's *f* (0221), for which  $\rho = 63^{\circ} 7'$ , the discrepancy in the angle being due to the poor quality of the reflection. The face is covered with overlapping triangular plates.

The forms and angles obtained are tabulated below:—

Form.		Measured.		Calculated.	
Goldschmidt	Dana	$\phi$	$\rho$	$\phi$	$\rho$
<i>a</i> 1010	<i>a</i> 1120	0 8	85 2	0 0	90 0
<i>p</i> 1121	<i>r</i> 1011	30 0	44 36	30 0	44 36
<i>m</i> 4481	<i>m</i> 4041	30 32	75 46	30 0	75 47
$\phi$ 2241	<i>f</i> 0221	30 1	66 55	30 0	63 7

## CHABAZITE.

Near Glen Innes, N.S.Wales.

(Pl. v., fig. 1.)

The chabazite associated with the crystals of calcite described above forms a continuous crust on the surface of decomposed basalt. The pale-yellow, translucent crystals are small, the average size being about that of the head of an ordinary pin, and they form botryoidal or stalactitic aggregates with a core of clayey decomposition products; chabazite apparently preceded calcite.

The crystal faces besides being minute are not brilliant and give rather poor reflections, but the measurements made with the reducing lens of the goniometer, were sufficient to identify the two forms  $s$  (0221) and  $l$  (1123) for which respectively the angle  $\rho$  was found to be  $66^{\circ} 53'$  (calc.  $68^{\circ} 16'$ ) and  $36^{\circ} 39'$  (calc.  $35^{\circ} 54'$ ). The only other form present is  $r$  (1011) from which however, no reflections were obtained, but there can be little doubt of its presence. The crystals are symmetrical penetration twins about the vertical axis, and the mineral would therefore be described as the phacolite variety. The twin structure is clearly revealed by the re-entrant angles in the equatorial region; these are produced by the meeting of the  $r$  and  $\bar{r}$  faces. The distribution of the faces of  $s$  is also a consequence of twinning. On the coplanar faces  $l$  and  $\bar{l}$  there is a depression, deepening towards the apex and with boundaries approximately parallel to the edges of the composite face.

To confirm the identification the water and silica percentages were determined and found to be 21.91 and 45.71 respectively; this is in close agreement with the published results of chabazite analyses.

## VESUVIANITE.

Arramagong, N.S.Wales.

(Pl. v., figs. 2, 3.)

I am informed by Mr. G. W. Card, Curator of the Mining and Geological Museum, that this mineral occurs in serpentine, close to its junction with granite at the Trigonometrical Station, Arramagong, between Grenfell and Young. The crystals are prismatic, small, the figured specimen measuring  $6 \times 1.5$  mm., honey-brown in colour and transparent. The forms present are  $c$  (001),  $a$  (100),  $m$  (110),  $f$  (120),  $\phi$  (350),  $p$  (111),  $l$  (331),  $s$  (131). Of the prisms, which are striated vertically,  $m$  is the largest,  $f$  is narrow and  $\phi$  was observed only once. The faces of  $s$  show slight striae parallel to their intersections with  $p$ ;  $p$  gives very good reflections and from the angles obtained the axial ratio was calculated. From twelve faces the average value of  $\rho$  was found to be  $37^{\circ} 17' 35''$  (limits  $37^{\circ} 16' - 37^{\circ} 20'$ ) therefore the vertical axis is .53853.

The forms represented and the measured and calculated co-ordinate angles are listed below.

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$
<i>c</i> 001	...	...	...	...
<i>a</i> 100	0 1	90 0	0 0	90 0
<i>m</i> 110	45 1	90 0	45 0	90 0
$\phi$ 350	31 41	90 0	30 58	90 0
<i>f</i> 120	26 38	90 0	26 34	90 0
<i>p</i> 111	45 0	37 18	45 0	(37 18)
<i>t</i> 331	45 2	66 21	45 0	66 22
<i>s</i> 131	18 24	59 34	18 26	59 35

## HEMATITE.

## New Hebrides.

(Pl. iii., figs. 4, 5.)

A small hand specimen from an unknown locality in the New Hebrides was submitted for identification and found to be crystallised hematite, variety specular iron, composed of tabular crystals measuring up to 15 mm. and smaller equi-dimensional crystals about 3 mm. in diameter. The faces are brilliant but inclined to be curved and the crystals are aggregated into small groups arranged in parallel position. Angular measurements were made on one of these parallel aggregates and the forms present were found to be *c* (0001), *a* (1120), *r* (1011), *u* (2243), the relative development of the forms being approximately as represented in the figures.

The measured and calculated angles are given in the subjoined table.

Forms.		Measured.		Calculated.	
Goldschmidt	Dana	$\phi$	$\rho$	$\phi$	$\rho$
		$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$	$\begin{smallmatrix} \circ & t \\ \dots & \dots \end{smallmatrix}$
<i>a</i> 0001	<i>c</i> 0001	...	...	...	...
<i>a</i> 1010	<i>a</i> 1120	30 9	90 7	30 0	90 0
<i>p</i> 1121	<i>r</i> 1011	0 1	57 35	0 0	57 33
$\lambda$ 2021	<i>u</i> 2243	30 0	61 14	30 0	61 10

## QUARTZ.

Howell, N.S.Wales.

(Pl. v., fig. 4.)

A fine example of quartz twinned on the Japan law from the Conrad Mine, Howell, was kindly lent for description by Mr. D. A. Porter. Each segment of the twin is about 4 cm. in length, tapers slightly to the apex and shows the usual prismatic striations. The crystals are flattened in the plane which contains the vertical axes, which seems to be an almost constant feature in twins of this kind. On the faces designated  $r$  (there are no means of distinguishing  $r$  from  $z$ ) appear raised etch figures of unsymmetrical shape as shown in the figure; on the  $z$  faces there are somewhat similar hillocks but they are less distinct and their exact form cannot be made out.

The group was measured with the co-planar faces  $m$  and  $\bar{m}$  polar, as it was found impossible to mount it in the conventional position; the  $r$  and  $z$  faces were utilised in centering and the angles obtained were as follows:—

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
$m$ 1010	2 35	60 1	0 0	60 0
$r : 1011$ {	90 0	38 13	90 0	38 13
	42 12	66 31	42 17	66 52
$\bar{m}$ 1010	85 22	60 0	84 33	60 0
$r : 1011$ {	3 55	38 13	5 27	38 13
	43 36	66 41	42 17	66 52
	52 30	66 40	53 10	66 52
$s$ 1121	60 37	89 55	60 6	90 0

## STIBNITE.

Hillgrove, N.S.Wales.

(Pl. v., figs. 5, 6.)

Stibnite occurs commonly in the Northern districts of New South Wales but the mineral is usually massive or in columnar and felted aggregates and very few well crystallised specimens are to be found in



collections; indeed, the example here described, from the Freehold Mine, is the first I have seen in which the crystals have distinct terminations. The hand specimen consists of an aggregate of prismatic crystals grouped partly in parallel or slightly divergent positions, several with terminations; some of the crystals are bent and distorted as is so commonly the case with stibnite, and in part the mineral is massive or imperfectly crystallised. Most of the crystals are slender, but a few are fairly stout, measuring nearly 1 cm. in thickness. The lustre is brilliant, resembling that of polished steel. A few small crystals of quartz are attached to the stibnite.

The measured crystal is short prismatic in habit, about 3 mm. in length and 1 mm. thick, and bent sharply not far from the terminated end. The faces are somewhat dull, probably from exposure, and the signals are not very sharp; most of the angles were measured with reducing lens. The prisms are deeply striated vertically and merge into one another.

Measured and calculated angles:—

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
<i>b</i> 010	0 29	89 14	0 0	90 0
<i>m</i> 110	45 20	90 0	45 13	90 0
<i>n</i> 210	63 19	90 0	63 46	90 0
<i>s</i> 113	45 2	25 46	45 13	25 43
<i>e</i> 123	26 44	36 17	26 44	37 13
$\psi$ 146	14 4	33 48	14 8	34 59

#### WOLFRAMITE.

Torrington, N.S.Wales.

(Pl. vi., figs. 1, 2.)

Although the wolframite mined in New South Wales is generally massive, crystals are not uncommon, particularly in the Torrington District, where, at the Wild Kate Mine, crystallised material was at one time abundant; unfortunately nearly all this material was smelted and no doubt many fine specimens were thus destroyed. Some crystals from this mine were previously described<sup>22</sup>, but they were rough, and measurement with a contact goniometer had to be relied on; the crystal

<sup>22</sup> Anderson—Rec. Austr. Mus., v., 5, 1904, pp. 303-304.

described in this paper has smoother faces and it was found possible to measure its angles on a reflecting goniometer, but the measurements are by no means good.

Mr. E. C. Andrews describes the mine as "a large granular quartz 'blow.' Worked by means of open cuts and shafts. Irregular masses of pegmatite (large, dark, vitreous quartz, feldspar and black mica) branch repeatedly through the 'quartz blow.' In these branches occur large stout crystalline masses of friable wolfram<sup>23</sup>." The Torrington ore is apparently near the ferberite end of the wolframite series<sup>24</sup>, the re-calculated analysis giving the percentage of manganous oxide as 3.95 ( $= \text{Mn WO}_4$  16.9%).

The crystal measures  $3 \times 3$  cm. along the directions of the  $b$  and  $c$  axes, but it was evidently a much larger crystal before fracture. As in wolframite the angle  $\beta$  is fairly close to  $90^\circ$ , the value chosen by Goldschmidt<sup>25</sup> being  $89^\circ 32'$ , the mean of determinations by Descloiseaux, Krenner and Seligmann, it is not easy to determine the positive or negative character of the forms when the angular measurements, as in this case, are not very accurate. The balance of the evidence favours the interpretation adopted, but, if the other setting is correct, then  $\sigma$  (121) and  $s$  (121),  $\omega$  (111) and  $o$  (111) will be interchanged, and the form  $t$  (102), present as a narrow face terminating a small segment in parallel position on  $a'$  will become  $y$  (102).

The measured and calculated angles are tabulated below:—

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	$^\circ$ $'$	$^\circ$ $'$	$^\circ$ $'$	$^\circ$ $'$
$a$ 100	91 10	90 18	90 0	90 0
$l$ 210	68 11	90 4	67 34	90 0
$m$ 110	51 41	89 56	50 27	90 0
$f$ 011	1 15	40 44	0 32	40 54
$t$ 102	—	26 3	90 0	27 19
$\omega$ 111	50 2	53 24	50 10	53 49
$o$ 111	51 13	53 23	50 14	53 34
$\sigma$ 121	29 30	62 59	31 24	63 46
$s$ 121	32 37	62 41	31 0	63 41

<sup>23</sup> Andrews—Ann. Rept. Dept. Mines, N.S.Wales, 1904 (1905), p. 143.

<sup>24</sup> Carne—Dept. Mines, N.S.Wales, Min. Res. No. 15, 1911, p. 70; Hess—Bull. U.S. Geol. Surv., 583, 1914, pp. 32-33.

<sup>25</sup> Goldschmidt—Winkeltabellen, 1897, p. 366.

## MONAZITE.

Dingo Creek, Torrington, N.S.Wales.

(Pl. vi., fig. 3.)

Although never found in large quantities monazite is fairly widely distributed in the State, and has been reported from several localities in the neighbourhood of Torrington; unfortunately the percentage of thorium is low.

The figured crystal, which is drawn in orthographic projection with the positive end of the *b* axis to the front, is only a fragment, about 1 cm. in greatest diameter, and it is very irregularly developed so that the correct orientation was difficult to discover. In habit the crystal is elongated parallel to the *b* axis with a tendency to tabularity on the plane of the axes *a* and *b*; the colour is reddish brown and the lustre resinous. Some of the faces are slightly wavy and many of the reflections are poor, but the measured and calculated angles are in fair agreement.

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	$\circ$ $'$	$\circ$ $'$	$\circ$ $'$	$\circ$ $'$
<i>c</i> 001	89 50	13 34	90 0	13 40
<i>b</i> 010	0 4	89 53	0 0	90 0
<i>a</i> 100	89 58	89 37	90 0	90 0
<i>l</i> 210	64 48	90 7	64 47	90 0
<i>m</i> 110	46 35	89 58	46 43	90 0
<i>n</i> 120	27 54	90 0	27 58	90 0
<i>g</i> 012	27 10	28 31	27 43	27 36
<i>e</i> 011	14 36	43 35	14 43	43 11
<i>u</i> 021	7 23	61 43	7 29	61 49
<i>x</i> 101	89 42	36 30	90 0	36 29
<i>i</i> 211	61 40	62 9	61 45	62 55
<i>e</i> 111	38 31	49 48	38 37	49 50
<i>d</i> 112	28 15	27 50	28 12	27 12

## CASSITERITE.

Pine Mountain, Inverell, N.S.Wales.

(Pl. vi., fig. 4.)

From this locality two untwinned crystals which present some features of interest have been lately acquired. One is fragmentary, with poor terminations, and dark brown to black in colour with honey-yellow patches, the other measures about 1.5  $\times$  1 cm., is doubly terminated and almost black. An interesting feature is the presence of the base which is a comparatively rare form in cassiterite. The largest faces belong to the forms  $r$  (230) and  $s$  (111); the other forms represented are  $c$  (001),  $a$  (100),  $h$  (120), and  $z$  (231), of which  $a$  and  $h$  are very narrow. The base is rough and yielded a very blurred reflection, while the prisms are poorly developed and the measurements obtained from them are approximate only; the faces of  $z$  are smooth and brilliant and give excellent reflections.

Angles :

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
$c$ 001	—	—	—	—
$a$ 100	1 14	88 56	0 0	90 0
$r$ 230	33 0	89 25	33 41	90 0
$h$ 120	28 5	88 21	26 34	90 0
$s$ 111	44 53	43 30	45 0	43 33
$z$ 231	33 39	67 33	33 41	67 35

Long Gully, near Tingha, N.S.Wales.

(Pl. vi., figs. 5, 6, Pl. vii., figs. 1, 2.)

From Long Gully, three miles south east of Tingha, comes a small collection of cassiterite crystals, the habit of which is quite unusual in Australian occurrences and by no means common generally; they belong to the variety called by the Cornish miners "needle tin" or "sparable" (? sparrowbill) tin," which is characterised by an acute pyramidal termination. In the Cornish crystals the termination is formed by faces of  $\sim$  (321) and (521)<sup>26</sup>. Here the steep pyramid is : (fig. 6) which is

<sup>26</sup> Miers. Mineralogy, 1902, p. 360.

in some cases modified by small faces of  $s$  (111) at the apex (fig. 1), or truncated by a rough and uneven basal pinacoid. Most of the crystals are simple, but twinning on the usual law is exemplified (fig. 2). The crystals are small, the largest being about 1.5 cm. in length and jet black in colour. Of the forms present  $k$  (340) is a fairly large face, the other prisms  $a$  (100) and  $m$  (110) being narrow: there are indications of the prism (130) for which the measured angle  $\phi$  was  $18^\circ 6'$  and  $19^\circ 3'$  (calculated  $18^\circ 26'$ ), but, as the prisms generally are striated and the signals poor, this is not included in the list of forms. The pyramid  $s$  (111) is small when present, but the faces are brilliant and give good signals.

## Forms and Angles:

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$c$ 001	—	—	—	—
$a$ 100	0 15	89 52	0 0	90 0
$m$ 110	44 57	89 57	45 0	90 0
$k$ 340	36 28	89 59	36 52	90 0
$s$ 111	45 0	43 33	45 0	43 33
$\pm$ 231	33 39	67 31	33 41	67 35
$k$ 340	26 52	42 11	26 44	42 12
$\pm$ 231 {	38 36	55 0	38 32	55 23
	35 10	69 40	35 25	70 42

Tingha (?), N.S.Wales.

(Pl. vii., figs. 4, 5.)

A small collection of crystallised cassiterite, believed to be from the Tingha district, exhibits an unusual habit. Practically all the crystals are composed of three portions, one of which is relatively large, doubly terminated and carries the two smaller portions twinned to it on two opposite faces of  $c$  (101); the composite crystal is inclined to be tabular in the plane containing the twin axes, and in shape is not unlike the letter S. The crystals are all small, the figured specimen measuring about 8 mm. in greatest length, and their uniformity in shape and development is very striking. Two opposite faces of  $a$  (100) are the largest planes on the crystals; one of these, shown in front in the figures, is smooth and brilliant and gives a good signal, although it is a composite face formed by coplanar portions of the three twinned segments. The  $a$

face at the back of the drawing is rough and irregular, and evidently the crystals were attached to the matrix by it; apparently the crystals were implanted on quartz. The base is usually present as a wavy face giving poor reflections. The faces of  $a$  (100) are smooth, with the exception of the face of attachment, but  $m$  (110) shows conchoidal markings and small etch pits.

## Forms and Angles :

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$c$ 001	—	—	—	—
$a$ 100	0 0	89 59	0 0	90 0
$m$ 110	45 2	90 2	45 0	90 0
$c$ 230	32 1	90 1	33 11	90 0
$h$ 120	26 30	90 4	26 34	90 0
$e$ 011	0 7	33 57	0 0	33 54
$s$ 111	45 2	43 33	15 0	43 33
$z$ 231	33 43	67 44	33 41	67 35
$t$ 133	18 53	35 20	18 26	35 19
$a$ 100	0 1	22 11	0 0	22 12
$m$ 110	20 37	48 55	20 41	49 6
$c$ 230	31 14	38 10	29 32	39 36
$h$ 120	36 59	34 0	37 5	34 6
$e$ 011	36 4	71 49	35 45	71 40
$z$ 231	6 45	31 10	6 56	31 6
	11 34	51 54	11 44	51 46
	38 38	55 22	38 32	55 23

## Pilbara, Western Australia.

(Pl. vii., fig. 3.)

This fine crystal, which is one of two kindly lent by Mr. W. T. Watkin Brown, is about 1 cm. in diameter; it is a doublet on the usual law and, since reentrant angles are practically absent, the twin looks at first like a simple crystal of pyramidal habit with a large number of faces. The planes are mostly well adapted to goniometric measurement, and the measured and calculated angles are in good agreement.

In addition to the forms which are listed in the table below  $\rho$  (750),  $r$  (572) and (241) are doubtfully present.

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$a$ 100	0 1	90 0	0 0	90 0
$m$ 110	44 58	90 0	45 0	90 0
$r$ 230	33 41	90 5	33 41	90 0
$h$ 120	26 38	90 2	26 34	90 0
$s$ 111	45 1	43 24	45 0	43 33
$t$ 133	18 21	35 23	18 26	35 19
$z$ 231	33 41	67 37	33 41	67 35
$h$ 120	37 25	33 52	37 5	34 6
$s$ 111	29 18	80 14	29 40	79 48
$z$ 231 {	35 24	70 42	35 25	70 42
	38 32	55 23	38 32	55 23
$t$ 133 {	10 45	78 27	10 48	78 30
	33 38	82 1	33 38	82 0

### CUPRITE.

Broken Hill, N.S.Wales.

(Pl. vii., fig. 6.)

In the Broken Hill lode the chief copper compounds are oxidised ores, the commonest being the blue and green carbonates and cuprite; lumps and dendritic masses of native copper and rare compounds such as marshite and miersite are also found. The cuprite occurs both massive and as well developed crystals in vughs and cracks or scattered over the surface of gossany material.

The finest specimen in the Australian Museum collection comes from the Broken Hill Proprietary Mine. The matrix in this case is a soft, black, amorphous substance which consists chiefly of lead, and reacts also for sulphur and copper, but a definite mineralogical name cannot be assigned to it; perhaps it is identical with the material which Dr. Hlawatsch, in his paper on stolzite and raspite from Broken Hill<sup>27</sup>, described as decomposed galena with a black friable surface ("zersetzter Bleiglanz mit muhniger schwarzer Oberfläche"), and with the "sooty sulphide ore" of Jaquet<sup>28</sup>. The cuprite crystals, which

<sup>27</sup> Hlawatsch—Ann. d. k. k. naturhist. Hofmus. Wien, xii., 1897, p. 33.

<sup>28</sup> Jaquet—Mem. Geol. Surv. N.S.Wales—Geol. No. 5, 1891, p. 88.

line cracks and cavities in the matrix, are not of large size, averaging about 3 mm. along the axes, and are octahedral in habit with long narrow faces of the dodecahedron and smaller faces of the trapezohedron  $n$  (211). The crystals in a freshly opened vugh are very brilliant and lustrous, some appearing almost black and metallic, others deep red and transparent, but after some years exposure they become brown and opaque. Other minerals on this hand specimen are garnet in small scattered crystals, occasional cerussite and granular or blebby quartz.

There are several specimens from the South Mine in the collection. The matrix of these is chiefly massive cuprite and limonite. The cuprite crystals, which are sometimes of fair size, measuring up to 1 cm. along the axes, are mainly octahedral in habit and dark brown to red in colour. In one hand specimen the crystals are superficially altered and covered with a dull grey film: in another, which consists of massive cuprite dusted over with yellow limonite, the crystallised cuprite is composed of numerous parallel and sub-parallel segments and partial crystals, with a small amount of the acicular chalcotrichite variety. In this specimen the crystals of cuprite are dark red to brick-red in colour and are accompanied by a little iodyrite in crystalline crusts. Professor Liviersidge has previously described and figured large cuprite crystals of cubic habit from the South Mine<sup>29</sup>.

An interesting specimen, of which the locality is given as Broken Hill simply, consists of massive cuprite, botryoidal malachite and granular quartz, with here and there perfect pseudomorphs of malachite after octahedral cuprite.

The figured crystal, which comes from the Proprietary Mine, yielded the following angles:—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
$d$ 101	0 4	44 56	0 0	45 0
" 111	45 9	54 34	45 0	54 44
" 112	45 4	35 16	45 0	35 16
" 121	27 20	65 56	26 34	65 51

#### Cadia, near Orange, N.S.Wales.

(Pl. viii., fig. 1.)

Fine crystals of cuprite are found in the oxidised portion of the Cadia Copper Mine. These crystals occupy vughs in an ironstone matrix, the vughs being lined with small concretionary mammillations with a velvety black surface, which, when broken, are seen to be steel-grey in

<sup>29</sup> Liviersidge—Journ. R. Soc. N.S.Wales, xxviii., 1894, p. 98.



colour, are not magnetic and readily dissolve in concentrated hydrochloric acid, the solution reacting for both ferrous and ferric iron. This crust is perhaps a mixture of magnetite and hematite. The crystals of cuprite are octahedral in habit and generally small, the largest measuring about 5 mm. in the axial directions, and the faces are in general smooth and brilliant. The variety chalcotrichite was formerly of common occurrence at Cadia, but it does not seem to be found in the present workings. The forms identified are the cube, the octahedron, the dodecahedron, and a new trapezohedron *l* (544) which was observed seven times on two crystals.

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	$\begin{smallmatrix} \circ & \circ \\ 0 & 2 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 3 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 0 \end{smallmatrix}$
<i>a</i> 100				
<i>d</i> { 110	$\begin{smallmatrix} \circ & \circ \\ 45 & 9 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 19 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 0 \end{smallmatrix}$
101	$\begin{smallmatrix} \circ & \circ \\ 0 & 13 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 44 & 57 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$
<i>o</i> 111	$\begin{smallmatrix} \circ & \circ \\ 45 & 1 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 54 & 29 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 54 & 44 \end{smallmatrix}$
<i>l</i> { 445	$\begin{smallmatrix} \circ & \circ \\ 44 & 48 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 48 & 20 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 48 & 32 \end{smallmatrix}$
454	$\begin{smallmatrix} \circ & \circ \\ 38 & 47 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 58 & 17 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 38 & 40 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 58 & 1 \end{smallmatrix}$

## Cloncurry, Queensland.

(Pl. viii., fig. 2.)

The hand specimen on which the figured crystal was obtained is composed mainly of massive cuprite and crystalline native copper. The crystals of cuprite are cubic in habit, measure up to 4 mm. along the cube edges, and are brownish red in colour; the only forms present are the cube, dodecahedron, and octahedron.

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	$\begin{smallmatrix} \circ & \circ \\ 0 & 5 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 5 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 0 \end{smallmatrix}$
<i>a</i> 100				
<i>d</i> { 110	$\begin{smallmatrix} \circ & \circ \\ 45 & 1 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 8 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 90 & 0 \end{smallmatrix}$
101	$\begin{smallmatrix} \circ & \circ \\ 0 & 20 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 0 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$
<i>o</i> 111	$\begin{smallmatrix} \circ & \circ \\ 44 & 50 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 54 & 46 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 45 & 0 \end{smallmatrix}$	$\begin{smallmatrix} \circ & \circ \\ 54 & 44 \end{smallmatrix}$

## Mount Lyell, Tasmania.

(Pl. viii., fig. 3.)

According to Petterd<sup>30</sup> enprite occurs in some abundance in the neighbourhood of Mount Lyell in finely formed crystals of octahedral habit attached to or partially embedded in blocks of nodular limonite: in one of our specimens it is accompanied by native copper. Four crystals were measured, their habit conforming more or less to that of the drawing: the octahedron and dodecahedron are well developed, the cube and the trapezohedron *u* (112) are small, and in addition there are small faces belonging to a new tetrahexahedron *r* (405), which was observed five times on one crystal and three times on another, the angle  $\rho$  for the face 045 varying between the limits  $37^{\circ} 45'$  and  $38^{\circ} 46'$  with an average value  $38^{\circ} 25'$  (calculated  $38^{\circ} 40'$ ).

## Angles:

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
<i>a</i> 100	0 0	89 56	0 0	90 0
<i>d</i> { 110	44 59	89 59	45 0	90 0
101	0 2	44 57	0 0	45 0
<i>o</i> 111	45 3	54 42	45 0	54 44
112	45 7	36 2	45 0	35 16
<i>u</i> 121	26 35	65 50	26 34	65 54
<i>r</i> { 405	0 2	38 25	0 0	38 39
504	0 3	50 0	0 0	51 20

## Stanley Copper Mine, Linda, Tasmania.

(Pl. viii., fig. 4.)

Two hand specimens from this old mine are in the Australian Museum collection. The matrix is concretionary and stalactitic limonite, and the enprite is accompanied by crystallised native copper. The crystals of enprite are of dodecahedral habit, almost transparent, and brilliant red in colour. In the figured specimen small faces of the cube and octahedron are present, occasional narrow planes of *u* and a probable new trisoctahedron *B* (155) appears as striae in the dodecahedral faces running parallel to their intersections with the octahedral planes. Nine measurements of *B* were obtained; of these the only two reasonably good

<sup>30</sup> Petterd—Catalogue of the Minerals of Tasmania, p. 61 (Hobart, 1910).

ones for the face 155 gave values for  $\phi$  of 11° 31' and 10° 30' (calculated 11° 19') and for  $\rho$  45° 34' and 45° 33' (calculated 45° 33'). For the face 551 the mean of six measurements gave  $\phi$  45° 1',  $\rho$  82° 26' (calculated 45° 0', 81° 57'). In another crystal the faces of the octahedron are larger, and two very narrow planes of a possibly new tetrahexahedron  $i$  (307) were observed, the values obtained for  $\rho$  being 23° 10' and 23° 18' (calculated 23° 12'). These two forms require confirmation before they are accepted.

Angles :

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$a$ 100	0 1	89 59	0 0	90 0
$d$ { 110	45 0	89 58	45 0	90 0
{ 101	0 0	45 0	0 0	45 0
$a$ 111	45 0	54 45	45 0	54 44
$i^*$ 307	0 46	23 14	0 0	23 12
$n$ { 112	45 3	35 9	45 0	35 16
{ 121	26 39	65 48	26 34	65 54
$B$ { 551	45 1	82 26	45 0	81 57
{ 155	11 0	45 33	11 19	45 33

#### MIMETITE.

Mount Bonnie, Northern Territory.

(Pl. viii., figs. 5, 6, 7.)

The Mount Bonnie Mine is in the Margaret District of the Woggaman Province, about four miles south of the point where the Darwin to Pine Creek railway crosses the Margaret River. According to Dr. H. I. Jensen<sup>31</sup> the lode may be regarded as a gash vein formed by strong movements on two fissure directions, and the surface shows a huge gossany ironstone outcrop containing small amounts of lead, gold, and silver. In a fifty feet shaft very good carbonated lead ore was encountered in a red vughy gossan. A tunnel was subsequently driven cutting the lode two hundred feet below the outcrop, but apparently the primary sulphide ore has not yet been reached.

The mimetite occurs in a reddish or yellowish gossan, the best crystals being found in vughs which are sometimes lined with botryoidal

<sup>31</sup> Jensen—Bull. North. Terr., No. 16, 1916, pp. 36, 37.

limonite, or, in one case, with a dull, steel-grey crust of psilomelane. The mimetite is well crystallised, and two somewhat different habits can be recognised: the larger crystals are tabular on the base, the prisms being short or absent, and measure up to 20 mm. in diameter, but these crystals are usually coarse and have a frosted appearance. The smaller crystals are prismatic and attain a length of 6 mm. with a diameter of about 3. Most of the crystals are almost white, with a slight yellowish or buff tinge, but on one hand specimen the mineral is distinctly yellowish and on another green. The crystals on these two specimens are thin tabular on the base and imperfectly formed, many consisting of an aggregate of parallel or sub-parallel groupings.

Nine crystals were measured, and the following forms, one of which,  $r$  (1012), is new, were identified:— $c$  (0001),  $m$  (1010),  $r$  (1012),  $x$  (1011),  $y$  (2021). Of these the base is never wanting and is usually a fairly large face;  $m$  is generally well developed though slightly striated horizontally, or it may be quite small or absent altogether; of the pyramids  $x$  is always present,  $y$  was found on three crystals and  $r$  on eight, both as long narrow faces. The new form  $r$  (1012) has been recorded for the closely allied species apatite and pyromorphite, but apparently has not hitherto been found on mimetite or vanadinite; the co-ordinate angles for  $r$  were found to be  $\phi$   $0^\circ 4'$ ,  $\rho$   $22^\circ 49'$  (calculated  $0^\circ 0'$  and  $22^\circ 47'$ ). These figures are the means derived from 23 measurements, the limiting values for  $\rho$  being  $22^\circ 9'$  and  $23^\circ 16'$ : the form may be considered established.

## Angles:

Forms.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
$c$ 0001	—	—	—	—
$m$ 1010	0 2	90 0	0 0	90 0
$r$ 1012	0 4	22 49	0 0	22 47
$x$ 1011	0 1	39 58	0 0	40 2
$y$ 2021	0 4	59 17	0 0	59 14

To confirm the identification of the mineral as mimetite a quantitative analysis was made of a crystal which appeared to be homogeneous and pure. For estimation of the lead, arsenic and phosphorus, 1.1024 gram was dissolved in caustic potash, the lead precipitated by ammonium sulphide and weighed in a Rose crucible. From the filtrate sulphide of arsenic was precipitated by addition of hydrochloric acid, filtered, washed, and oxidised by strong nitric acid. The arsenic acid was precipitated by addition of ammonia and magnesia mixture, and weighed as magnesium

pyro-arsenate. The filtrate from sulphide of arsenic was evaporated, rendered alkaline with ammonia, and phosphoric acid precipitated by magnesia mixture. Chlorine was determined in another portion weighing .9595 gram, which was dissolved in nitric acid and precipitated with silver nitrate. The result was as follows:—

Pb O	...	...	...	76.22
As <sub>2</sub> O <sub>5</sub>	...	...	...	20.55
P <sub>2</sub> O <sub>5</sub>	...	...	...	1.41
Cl	...	...	...	2.00
				<hr/>
				100.18
Less oxygen equivalent to				
chlorine	...	...	...	.45
				<hr/>
				99.73
				<hr/>

In conclusion, I have to record my indebtedness to Messrs. W. T. Watkin Brown, D. A. Porter and G. Smith for the loan of specimens, and to Messrs. B. J. Smart, B.Sc., and H. E. M. Curry, of the Testing Branch, Department of Public Works, through whose kind offices the artificially etched crystal of beryl was photographed.





EXPLANATION OF PLATE I.

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Beryl, Torrington, N.S.Wales.

Figs. 1, 2. Crystal i.; Note the etched band between prisms and pyramids.

Fig. 3. Crystal x.; The crystal is tilted so as to show the elevations and markings on the base.

„ 4. Crystal vi; this shows the etching between prisms and pyramids and hexagonal markings on the base.

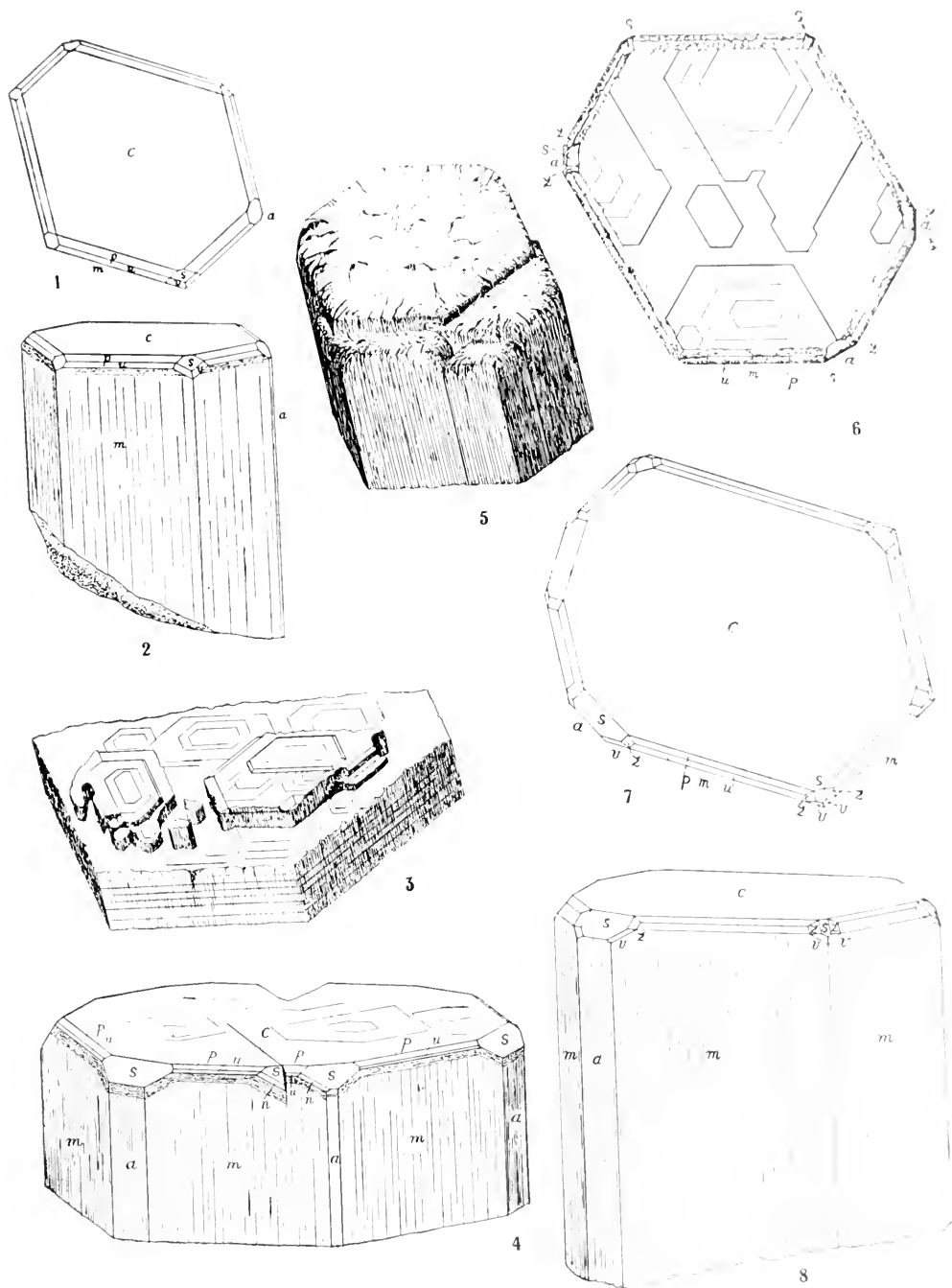
„ 5. Crystal xiv.; this is a composite crystal, consisting of four individuals, the terminations rounded and pyramid faces completely obliterated.

„ 6. Crystal vii.; here the pyramids have been strongly attacked but are still identifiable, and the hexagonal markings on the base are strongly marked.

Figs. 7, 8. Crystal viii.; in these figures the markings on the base are not shown (compare Pl. ii., fig. 7).

Forms :—*c* (0001), *a* (1120), *m* (1010), *p* (1011) *n* (2021), *s* (1121),  
*e* (2131), *z* (4263), *u* (3141).









EXPLANATION OF PLATE II.

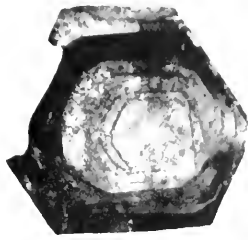
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Beryl, Torrington, N.S.Wales.

- Fig. 1. Crystal xv.; this crystal, the termination of which is directed downwards, shows signs of prolonged etching, the prism faces being deeply fluted and the base reduced to a number of isolated pinnacles.— $\frac{1}{1}$
- „ 2. Crystal xiii.; showing zonal growth.—about  $\frac{6}{5}$
- „ 3. Base etched with caustic soda.— $\frac{20}{1}$
- „ 4. Crystal xii.; natural etch figures on the base. The figures are hexagonal depressions disposed in an approximately linear manner.—about  $\frac{9}{4}$
- „ 5. Etch figure on base of crystal xii. enlarged.
- „ 6. Crystal ix.; the base of this crystal is intersected by “gullies” separating elevations of hexagonal form.—about  $\frac{1}{1}$
- „ 7. Crystal viii.; base with numerous hexagonal elevations and markings and linear depressions.—about  $\frac{3}{2}$



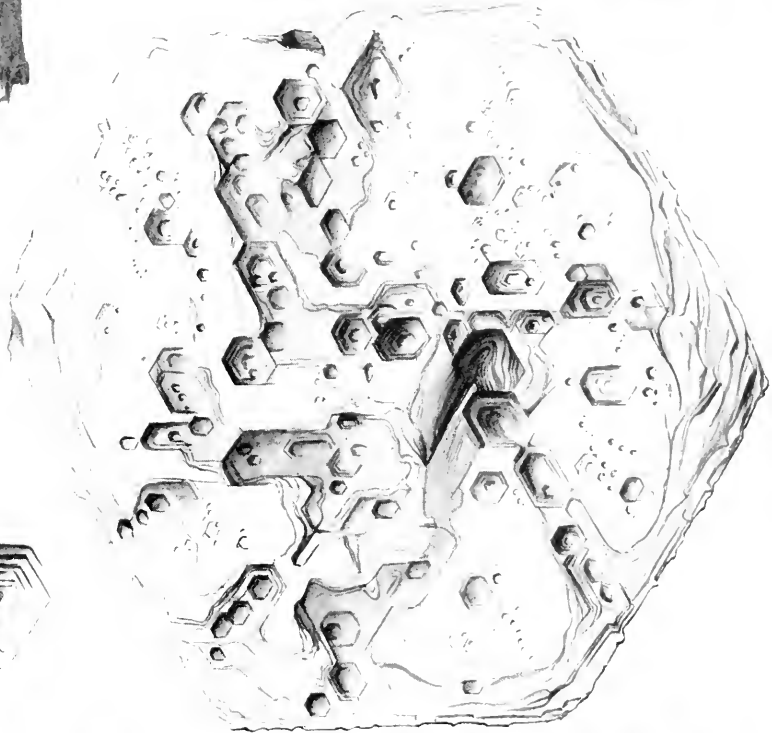
1



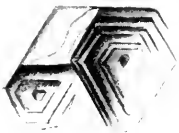
2



3



4



5



6



7

PHYLLIS F. CLARKE (4, 5,) del.  
H. E. M. CURRY (3) photo.  
C. CLUTTON (1, 2, 6, 7) photo.





EXPLANATION OF PLATE III.

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Figs. 1, 2. Calcite, Belubula Caves, near Mandurama, N.S.Wales.

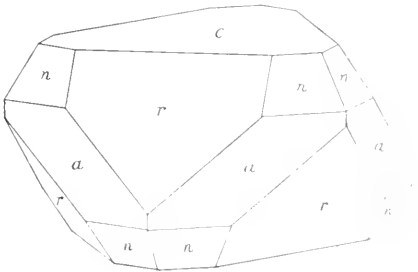
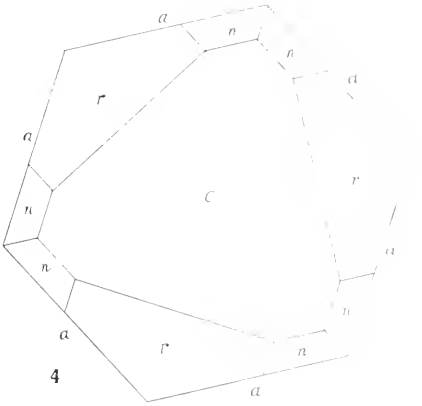
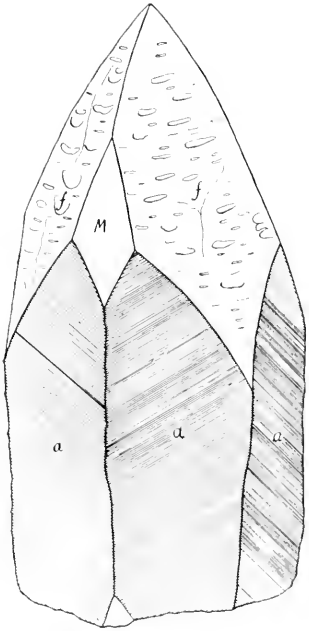
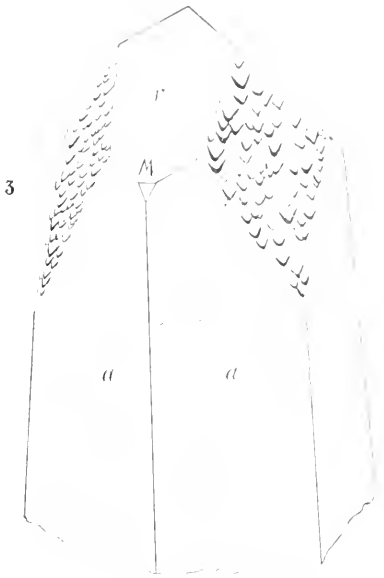
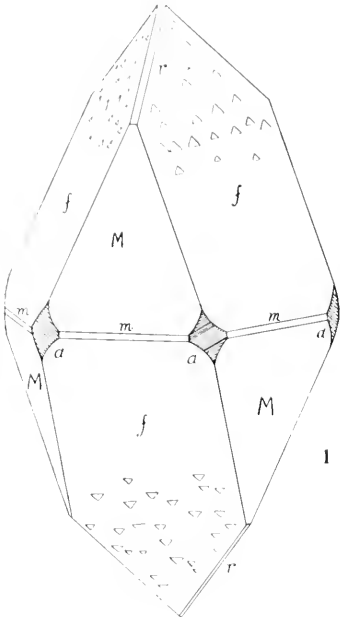
Fig. 3. Calcite, near Glen Innes, N.S.Wales.

Forms:— $a$  (1120),  $m$  (1010),  $r$  (1011),  $M$  (4041),  $f$  (0221).

Figs. 4, 5. Hematite, New Hebrides, West Pacific.

Forms:— $c$  (0001),  $a$  (1120),  $r$  (1011),  $u$  (2243).









EXPLANATION OF PLATE IV.

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Calcite, Belubula Caves, near Mandurama, N.S.Wales ; all figures about natural size.

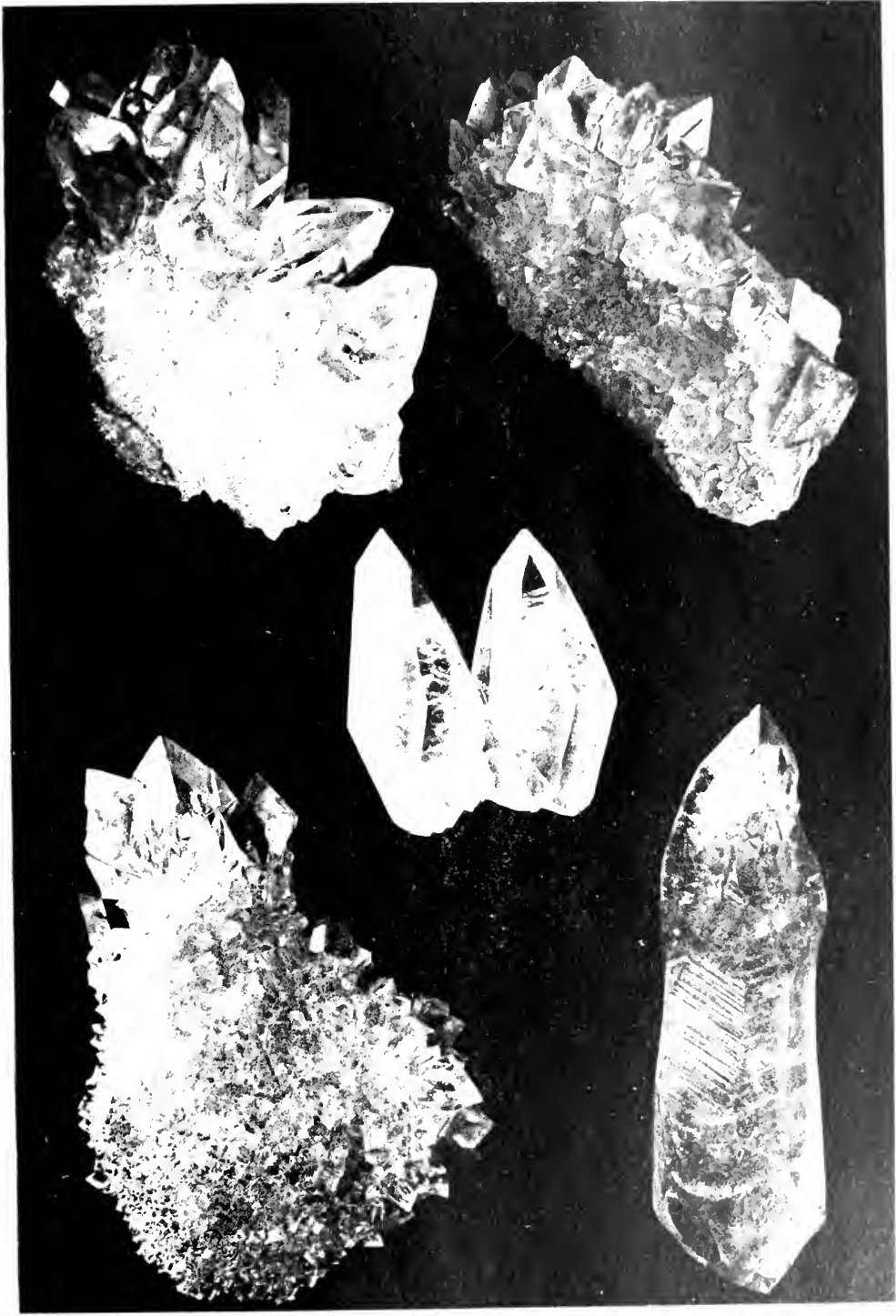
1

2

3

5

4



C. CLUTTON, photo.





EXPLANATION OF PLATE V.

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Fig. 1. Chabazite, near Glen Innes, N.S.Wales: phacolite type, twinned on vertical axis.

Forms:— $r$  (1011),  $s$  (0221),  $t$  (1123).

Figs. 2, 3. Vesuvianite, Arramagong, N.S.Wales.

Forms:— $c$  (001),  $a$  (100),  $m$  (110),  $\phi$  (350),  $f$  (120),  
 $p$  (111),  $t$  (331),  $s$  (131).

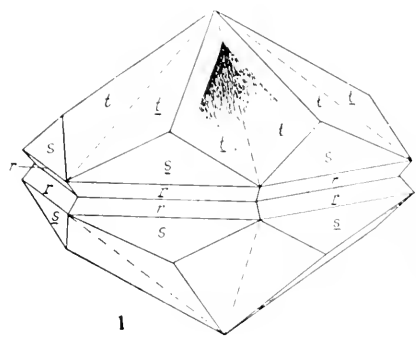
Fig. 4. Quartz, Howell, N.S.Wales: twinned on 1122 (Japan law).

Forms:— $m$  (1010),  $r$  (1011),  $z$  (0111),  $s$  (1121).

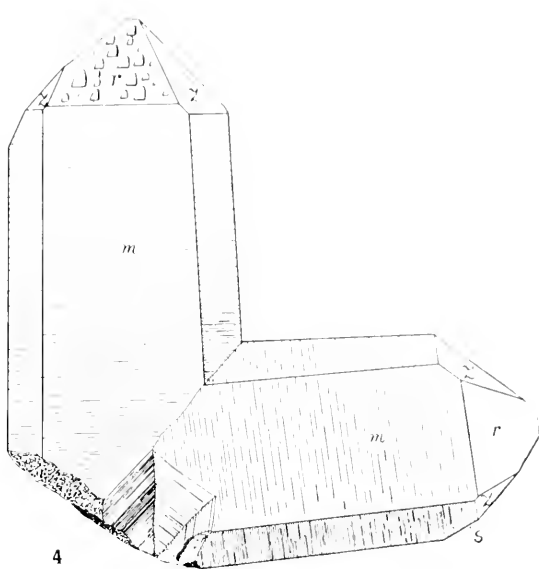
„ 5. Stibnite, Hillgrove, N.S.Wales.

„ 6. Forms:— $b$  (010),  $m$  (110),  $u$  (210),  $s$  (113),  $v$  (123),  
 $\psi$  (146).

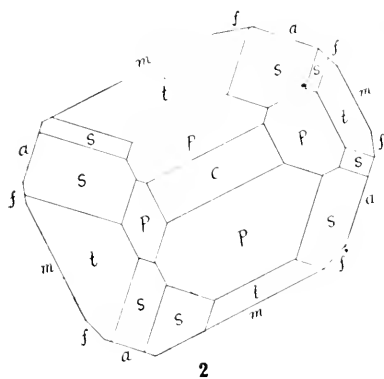




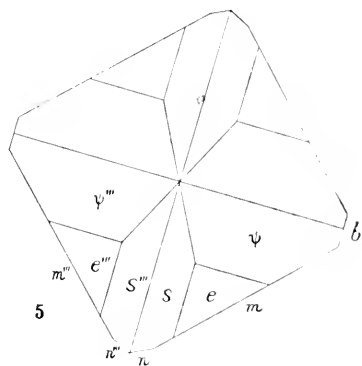
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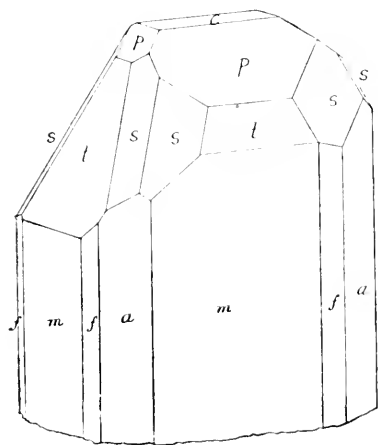
4



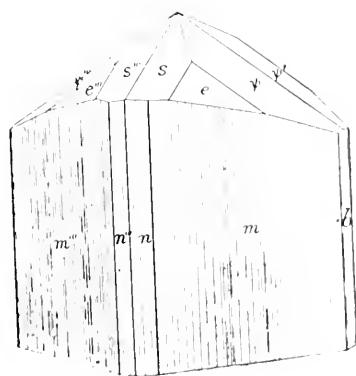
2



5



3



6





EXPLANATION OF PLATE VI.

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Figs. 1, 2. Wolframite, Wild Kate Mine, Torrington, N.S.Wales.

Forms:— $u$  (100),  $l$  (210),  $m$  (110),  $f$  (011),  $t$  (102),  
 $\omega$  (111),  $o$  (111),  $\sigma$  (121),  $s$  (121).

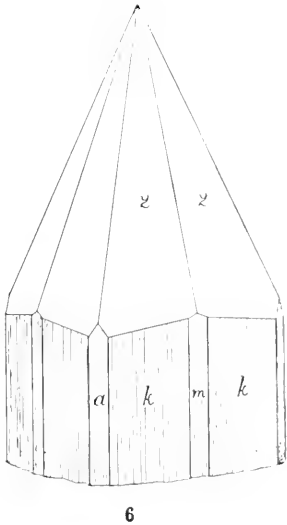
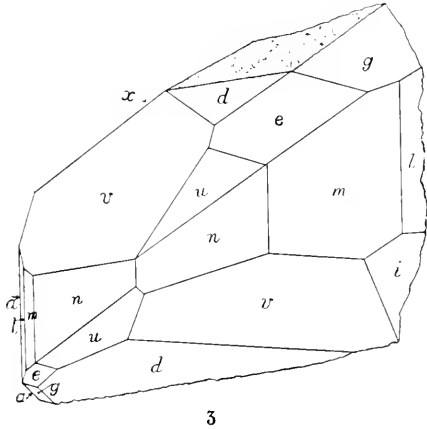
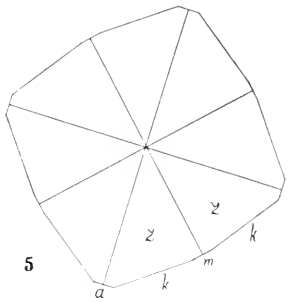
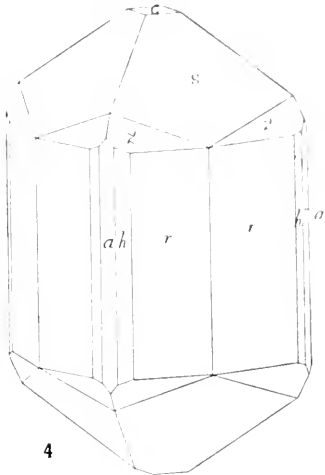
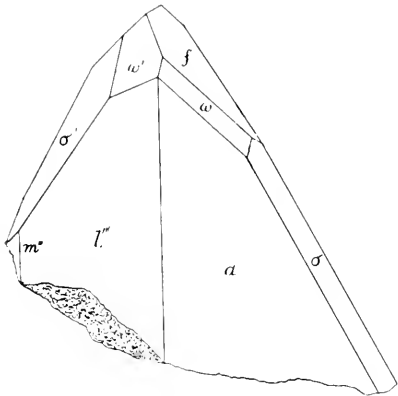
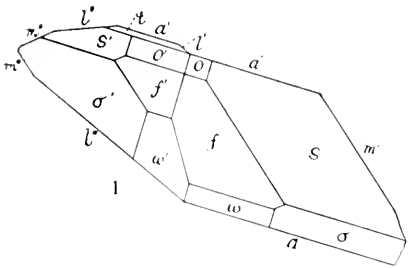
Fig. 3. Monazite, Dingo Creek, Torrington, N.S.Wales.

Forms:— $c$  (001),  $h$  (010),  $a$  (100),  $l$  (210),  $m$  (110),  
 $n$  (120),  $g$  (012),  $e$  (011),  $u$  (021),  $x$  (101),  
 $i$  (211),  $e$  (111),  $d$  (112).

„ 4. Cassiterite, Pine Mountain, Inverell, N.S.Wales.

Figs. 5, 6. Cassiterite, Long Gully, near Tingha, N.S.Wales.

Forms:— $c$  (001),  $a$  (100),  $m$  (110),  $k$  (340),  $r$  (230),  
 $h$  (120),  $s$  (111),  $z$  (231).







EXPLANATION OF PLATE VII.

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Figs. 1, 2. Cassiterite, Long Gully, near Tingha, N.S.Wales; fig. 2 twinned on  $c$ .

Fig. 3. Cassiterite, Pilbara, Western Australia; doublet on  $c$ .

Figs. 4, 5. Cassiterite, Tingha (?), N.S.Wales; triplet on  $c$ .

Forms:— $c$  (001),  $a$  (100),  $m$  (110),  $k$  (340),  $r$  (230),  
 $h$  (120),  $i$  (011),  $s$  (111),  $z$  (231),  $t$  (133).

Fig. 6. Cuprite, Broken Hill, N.S.Wales.

Forms:— $d$  (110),  $v$  (111),  $u$  (112).









EXPLANATION OF PLATE VIII.

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Fig. 1. Cuprite, Cadia, near Orange, N.S.Wales.

„ 2. Cuprite, Cloncurry, Queensland.

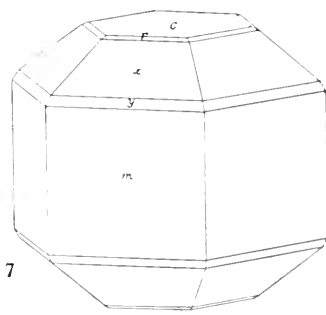
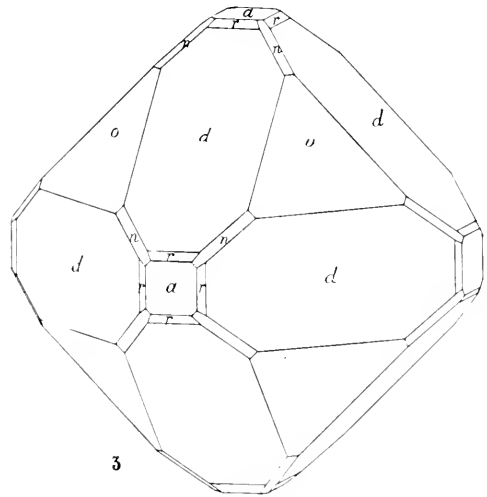
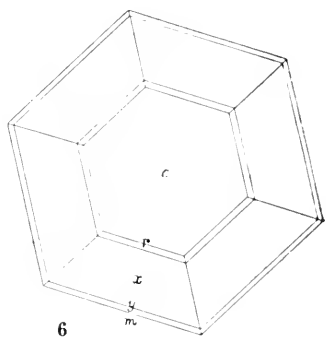
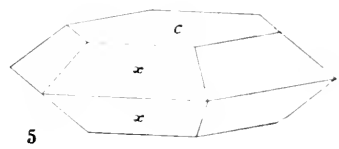
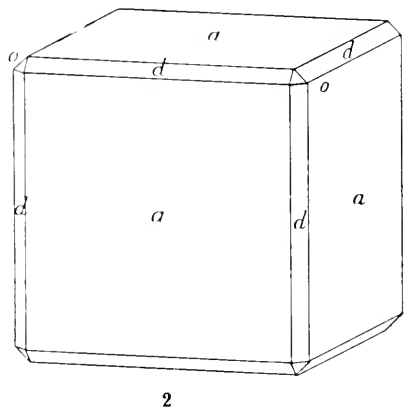
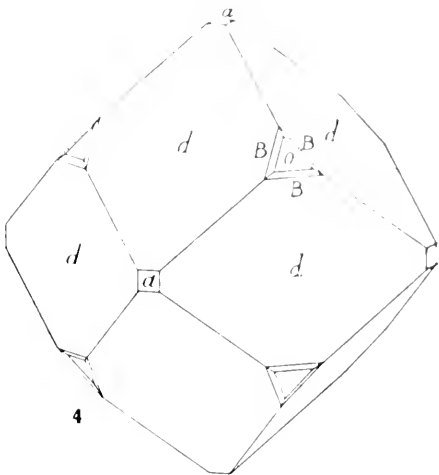
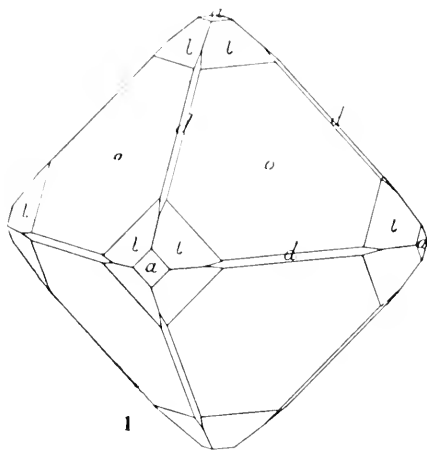
„ 3. Cuprite, Mount Lyell, Tasmania.

„ 4. Cuprite, Stanley Mine, Linda, Tasmania.

Forms:—*a* (100), *d* (110), *r* (045), *o* (111), *u* (112),  
*l* (445), *B* (155).

Figs. 5, 6, 7. Mimetite, Mount Bonnie, Northern Territory.

Forms:—*r* (0001), *m* (1010), *r* (1012), *s* (1011), *g* (2021).





# NOTES ON FLIES OF THE GENUS PELECORHYNCHUS (TABANIDÆ).

BY

G. H. HARDY, late of the Tasmanian Museum, Hobart.

(Plate ix.)

This paper contains a complete catalogue of references to the Australian species of *Pelecorhynchus*, the description of a new species and a key to those described. Thoracic markings are illustrated from such type specimens as are available for study.

Over one hundred specimens have been examined, representing all the known species, four of which, *P. distinctus*, Taylor, *P. lillyardi*, Taylor, *P. claripennis*, Ricardo, and *P. denquetti*, sp. nov., are only known from the female.

*Pelecorhynchus personatus*, Walker (= *P. maculipennis*, Macquart), seems to have been unrecognised in Australian collections and confused with *P. nigripennis*, Ricardo, from which it is distinguished by doubtful characters. Future investigation will probably show these to be variations of the same species.

## Key to the species of *Pelecorhynchus*.

1. Abdomen with tomentum covering the whole surface, not shining..... 2.  
     Abdomen bare, or almost bare, shining.....12.
2. Abdomen with transverse bands; longitudinal stripes are sometimes also present .....3.  
     Abdomen with at least one longitudinal stripe and without transverse bands.....10.
3. The lighter coloured bands are entire, without interruptions in the centre, and are sometimes obscure.....4.  
     The lighter coloured bands are interrupted, sometimes forming spots on each side of the dorsal stripe.....6.
4. Bands obscure, with tendencies to being interrupted on either side of centre, never centrally. Thorax with a pair of white stripes on anterior half. Eyes separate in ♂ .....*igniculus*.  
     Bands conspicuous.....5.
5. Spots on wings pale brown, pubescence on anterior part of sides of thorax blackish, hairs on base of cheeks yellow.....*personatus*.  
     Spots on wings deep blackish brown and larger, pubescence on anterior part of sides of thorax and hairs on base of cheeks reddish.....*nigripennis*.
6. Eyes widely separated in ♂, abdomen with a pair of spots on each segment caused by one median and a pair of lateral stripes confining the interrupted lighter bands to more or less triangular areas.....*mirabilis* ♂.  
     Eyes contiguous in ♂, abdomen with conspicuous bands interrupted in the centre.....7.
7. A white stripe on the black stripe of the thorax, wings spotted, abdomen without red hairs.....*albolineatus*.  
     A white spot, sometimes absent, on the black stripe of the thorax.....8.
8. Abdomen with red hairs, wings spotted.....*cristaloides*.  
     Abdomen without red hairs, wings not spotted.....9.

9. The white spot on the thorax conspicuous, the black centre stripe of scutellum not extending on to thorax.....*montanus*.  
 The white spot on thorax obscure or absent, the black stripe of scutellum extends on to thorax.....*montanus* var. *a*.
10. Abdominal median stripe interrupted at posterior margin of segments, not reaching apex; a pair of lateral stripes more or less complete.....*mirabilis* ?.  
 Abdominal stripe entire, not interrupted, sometimes not reaching apex of abdomen.....11.
11. Thorax yellow, with three broad black stripes, abdomen with one median black stripe.....*distinctus*.  
 Thorax black, with broad reddish yellow stripe occupying half its width; abdomen with one median and two lateral black stripes.....*fulvus* ?.
12. Abdomen twice as long as wide, sides parallel; black species with partly yellow antennae; a median broad grey stripe on thorax; basal segment of abdomen with a little grey tomentum.....*tillyardi*.  
 Abdomen not much longer than wide, sides never parallel, generally conical... 13.
13. Abdomen shining reddish brown; pubescence largely red.....*claripennis*.  
 Abdomen shining black.....14.
14. Wings obscure fuscous, without markings; no red pubescence.....*fuscconiger*.  
 Wings yellow.....15.
15. Wings with posterior border and some incomplete bands black. Thorax black with two broad, closely adjacent yellow stripes.....*denqueti*, *sp. nov.*  
 Wings with one sub-apical blotch black; thorax with one broad reddish yellow stripe .....*fulvus* ♂.

PELECORHYNCHUS IGNICULUS, *Hardy*.

(Pl. ix., fig. 1.)

*Pelecorhynchus igniculus*, Hardy, Proc. Roy. Soc. Tas., 1917 (1918), p. 64.

*Types*.—Holotype and allotype in the Australian Museum.

PELECORHYNCHUS ALEOLINEATUS, *Hardy*.

(Pl. ix., fig. 4.)

*Pelecorhynchus aleolineatus*, Hardy, Proc. Roy. Soc. Tas., 1917 (1918), p. 64.

*Types*.—Holotype, allotype and paratype (♀) in the Australian Museum.

PELECORHYNCHUS MONTANUS, *Hardy*.

(Pl. ix., figs. 2, 3.)

*Pelecorhynchus cristatoides* var. *montanus*, Hardy, Proc. Roy. Soc. Tas., 1916 (1917), p. 269.

*Pelecorhynchus montanus*, Hardy, *loc. cit.*, 1917 (1918), p. 65.



*Obs.*—Specimens from Cradle Mountain differ from those from Mount Wellington in the markings of the thorax, the colour of some of the hairs, and also in other small details. The Cradle Mountain specimens have been designated *P. montanus* var. *a.* by me (*Loc. cit.*, 1918), but it is probable that they will be found to merge into the typical form when material is available from other localities for comparison.

*Types.*—The holotype and allotype of the typical form and also the holotype and allotype of the var. *a.* are in the Australian Museum.

PELECORHYNCHUS ERISTALOIDES, Walker.

*Silvius ? eristaloides*, Walker, List Dipt. Brit. Mus., i., 1848, p. 193.

*Dasybasis eristaloides*, Walker, *Op. cit.*, v. suppl. 1, 1854, p. 267.

*Pelecorhynchus eristaloides*, Ricardo, Ann. Mag. Nat. Hist. (7), v., 1900, p. 102; *Loc. cit.* (8), v., 1910, p. 405. *Id.*, White, Proc. Roy. Soc. Tas., 1915 (1916), p. 22. *Id.*, Hardy, Proc. Roy. Soc. Tas., 1915 (1916), p. 60; *Loc. cit.*, 1916, p. 269; *Loc. cit.*, 1917 (1918), p. 63 (in key). *Id.*, Ricardo, Ann. Mag. Nat. Hist. (8), xix., 1917, p. 211.

*Loc.*—New South Wales; one male in the Macleay Museum has the white spot on the thorax obsolete.

PELECORHYNCHUS PERSONATUS, Walker.

*Silvius ? personatus*, Walker, List Dipt. Brit. Mus., i., 1848, p. 192.

*Dasybasis personatus*, Walker, *Op. cit.*, v. suppl. 1, 1854, p. 267.

*Pelecorhynchus maculipennis*, Macquart, Dipt. Exot., suppl. 4, 1850, p. 23, pl. ii., fig. 6. *Id.*, Ricardo, Ann. Mag. Nat. Hist. (8), v., 1910, p. 403. *Id.*, Taylor, Proc. Linn. Soc. N.S.Wales, xlii., 1917, p. 513.

*Ctenomygus maculipennis*, Thomson, Eugenes Resa, Dipt. 1868, p. 450, pl. ix., fig. 2.

*Pelecorhynchus ornatus*, Schiner, Novara Reise, Dipt. 1868, p. 98. *Id.*, Williston, Kansas Univ. Quart., iii., 1895, p. 192.

*Pelecorhynchus nigripennis*, Taylor, Proc. Linn. Soc. N.S.Wales, xliv., 1919, p. 41. *Id.*, Taylor, Rec. Austr. Mus., xii., 5, 1918, p. 55 (part). —(not *P. nigripennis*, Ricardo).

*Synonymy.*—Miss Ricardo definitely states that Walker's type of *Silvius personatus* is identical with Macquart's genotype *P. maculipennis*, but although Walker's name has priority she has used Macquart's name in preference, and in this has been followed by all subsequent entomologists.

The species has not been satisfactorily recognised in Australian collections but undoubtedly Sydney specimens and Stradbroke Island specimens belong here. A specimen from the latter locality is in the

Australian Museum, and was recorded by Mr. F. H. Taylor (*Loc. cit.*, 1918) under the name *P. nigripennis*; but his Ebor specimen mentioned first in the same reference is correctly named. Other specimens identified by Mr. Taylor from Stradbroke Island, in the Queensland Museum, under the name *P. maculipennis* (1917), which he changed later to *P. nigripennis* (1919), were probably correctly named in the first place. On this account these references are placed in the synonymy above.

*Status*.—The difference between *P. personatus* and *P. nigripennis*, if indeed they are distinct, is small; fresh specimens show that the abdomen has bands equally dark in both species instead of being reddish brown and blackish brown respectively. There is an extra distinction, however, in the pubescence under the head and the thorax which is pale yellow in *P. personatus* and white with tufts of red in *P. nigripennis*. The thorax has far less red pubescence dorsally in the former than in the latter.

*Variations*.—In the Macleay Museum three males and five females from Ropes Creek, Burradoo and the Blue Mountains, New South Wales, are referable here. They all, however, show a marked tendency towards *P. nigripennis* in the wing markings, but all agree with *P. personatus* in the comparative scantiness of the red pubescence, and the pale yellow hair ventrally. The spots on the wings vary from seven to ten in number.

*Loc*.—The specimen upon which this identification is based is in the Australian Museum; it was taken by the writer at La Perouse, Botany Bay, New South Wales, on the 6th October, 1918, and is a male; a second specimen, a female, from the same locality, having the spots of the wing approaching those of *P. nigripennis*, was taken on the 12th October, 1919. A further specimen, a female, was taken at Blackheath, New South Wales, on the 18th November, 1919.

So far as is known it appears that this form occurs in warmer climates, whilst the next species is from mountain and colder areas, including Tasmania.

#### PELECORHYNCHUS NIGRIPENNIS, Ricardo.

*Pelecorhynchus maculipennis*, Ricardo, Ann. Mag. Nat. Hist. (7), v., 1900, p. 102—(not *P. maculipennis*, Macquart).

*Pelecorhynchus nigripennis*, Ricardo, Ann. Mag. Nat. Hist. (8), v., 1910, p. 405. *Id.*, White, Proc. Roy. Soc. Tas., 1915 (1916), p. 22. *Id.*, Hardy, Proc. Roy. Soc. Tas., 1915 (1916), p. 60; *loc. cit.*, 1917 (1918), p. 63 (in key). *Id.*, Taylor, Rec. Austr. Mus., xii., 5, 1918, p. 55.

*Status*.—For observations upon the status of this species see the remarks under *P. personatus*.

#### PELECORHYNCHUS MIRABILIS, Taylor.

*Pelecorhynchus mirabilis*, Taylor, Proc. Linn. Soc. N.S.Wales, xlii., 1917, p. 513.

*Obs.*—This is not represented in the Australian Museum. The sexes have similar thoracic markings and remarkably dissimilar abdominal markings; the character of the separated eyes of the male is shared with *P. igniculus* and *P. fulvus*. Dr. E. W. Ferguson has kindly lent me two males and two females for the inclusion of their characters in the key.

*PELECORHYNCHUS TILLYARDI, Taylor.*

(Pl. ix., fig. 6.)

*Pelecorhynchus tillyardi*, Taylor, Rec. Austr. Mus., xii., 5, 1918, p. 54.

*Obs.*—The shape of the abdomen in the type specimen is quite different to that of any described species.

*Type.*—The unique female holotype is in the Australian Museum.

*PELECORHYNCHUS CLARIPENNIS, Ricardo.*

*Pelecorhynchus claripennis*, Ricardo, Ann. Mag. Nat. Hist. (8), v., 1910, p. 408.

*Obs.*—This species is remarkably closely allied to *P. fusconiger*, Walker. It has similar thoracic markings, can only be distinguished by the reddish instead of black abdomen, and by the abundant red pubescence. Two females were kindly lent to me by Dr. E. W. Ferguson for inclusion of their characters in the key; two females are in the Macleay Museum.

*PELECORHYNCHUS FUSCONIGER, Walker.*

*Silvius ? fusconiger*, Walker, List Dipt. Brit. Mus., i. 1848, p. 192.

*Dasybasis fusconiger*, Walker, *Op. cit.*, v. suppl. 1, 1854, p. 267.

*Pelecorhynchus fusconiger*, Ricardo, Ann. Mag. Nat. Hist. (7), v., 1900, p. 102; *Loc. cit.* (8), v., 1910, p. 407. *Id.*, Hardy, Proc. Roy. Soc. Tas., 1915 (1916), p. 60; *Loc. cit.*, 1916 (1917), p. 270; *Loc. cit.*, 1917 (1918), p. 63 (in key). *Id.*, Taylor, Proc. Linn. Soc. N.S.Wales, xlii., 1917, p. 513. *Id.*, Taylor, Rec. Austr. Mus. 1918, xii. 5, p. 55.

*Variation.*—A specimen taken at Blackheath, New South Wales, on the 13th November, 1919, has thick red pubescence below and behind the head; on the thorax there are some conspicuous red hairs above the wings; some of the abdominal segments have red hairs laterally. This variety approaches *P. claripennis*, Ric., and suggests that that species is only a variation of *P. fusconiger*, Walk.

*Loc.*—New South Wales: La Perouse, one male, 12th October, 1919, also eight males and seven females, 19th October, 1919; Blackheath, 10 males and nine females, from 12th to 24th November, 1919.

PELECORHYNCHUS DISTINCTUS, *Taylor*.

(Pl. ix., fig. 5.)

*Pelecorhynchus distinctus*, Taylor, Rec. Anstr. Mus., xii., 1918, p. 53.

*Type*.—The holotype and paratype, both females, are in the Australian Museum. The male is unknown.

PELECORHYNCHUS FULVUS, *Ricardo*.

*Pelecorhynchus fulvus*, Ricardo, Ann. Mag. Nat. Hist. (8), v., 1910, p. 406. *Id.*, Taylor, Proc. Linn. Soc. N.S.Wales, xliv., 1919, p. 41.

*Loc*.—Sutherland, New South Wales, one female, taken by Mr. C. F. Deuquet. Dr. E. W. Ferguson has kindly lent me a male specimen for the determination of characters suitable for the key.

PELECORHYNCHUS DEUQUETI, *sp. nov.*

(Pl. ix., fig. 7.)

♀. A yellow and black species; the abdomen is bare, shining, and black; the wings are yellow with their posterior borders and spots black. The tomentum of the head is ashy grey; the pubescence on the face and cheeks is black mixed with a little white, whilst that of the front and behind the head is black; the beard is whitish. The proboscis is black, the palpi reddish yellow, and the antennæ reddish yellow with a fuscous stain on their basal segments. Thorax with a thin black median stripe which widens posteriorly and extends on to the scutellum. Two very broad yellowish stripes are on each side of the median line. Within each of these there is a brighter stripe running the full length of the thorax and touching the apex of the transverse suture. There is an irregular black lateral stripe, but a small area above the roots of the wing is yellowish; the remainder of the thorax and the sides of the scutellum are greyish. The fringe of the scutellum is black on the black part and whitish on the grey part. The ventral part of the thorax and the coxæ are grey with white pubescence, the remainder of the legs are yellow. Abdomen shining black with pubescence yellow. Wings reddish yellow with a black posterior border; a black posterior band extends across each at the base of the discal cell, but does not reach the costa; another band at the apex of the discal cell is interrupted and leaves an isolated spot at about the middle of the radial vein; a third band at the cubital fork is curved and, with the posterior marginal band, encloses a yellow area. The markings are not quite uniform in each wing but all the bands are confluent with the posterior border.

Length, 14 mm.; width across the wings about 35 mm.

This species is named after the collector of the holotype, Mr. C. F. Deuquet.

*Locs.*—Blackheath, New South Wales, December, 1918; one female, the holotype, in the Australian Museum. In the Macleay Museum there is a female paratype, from the Blue Mountains, New South Wales, also a female from Mount Kosciuszko, New South Wales, which is referable here, but has an entirely black thorax and is slighter in build. Both specimens have the band across the wing at the base of the discoidal cell interrupted before reaching the posterior border.





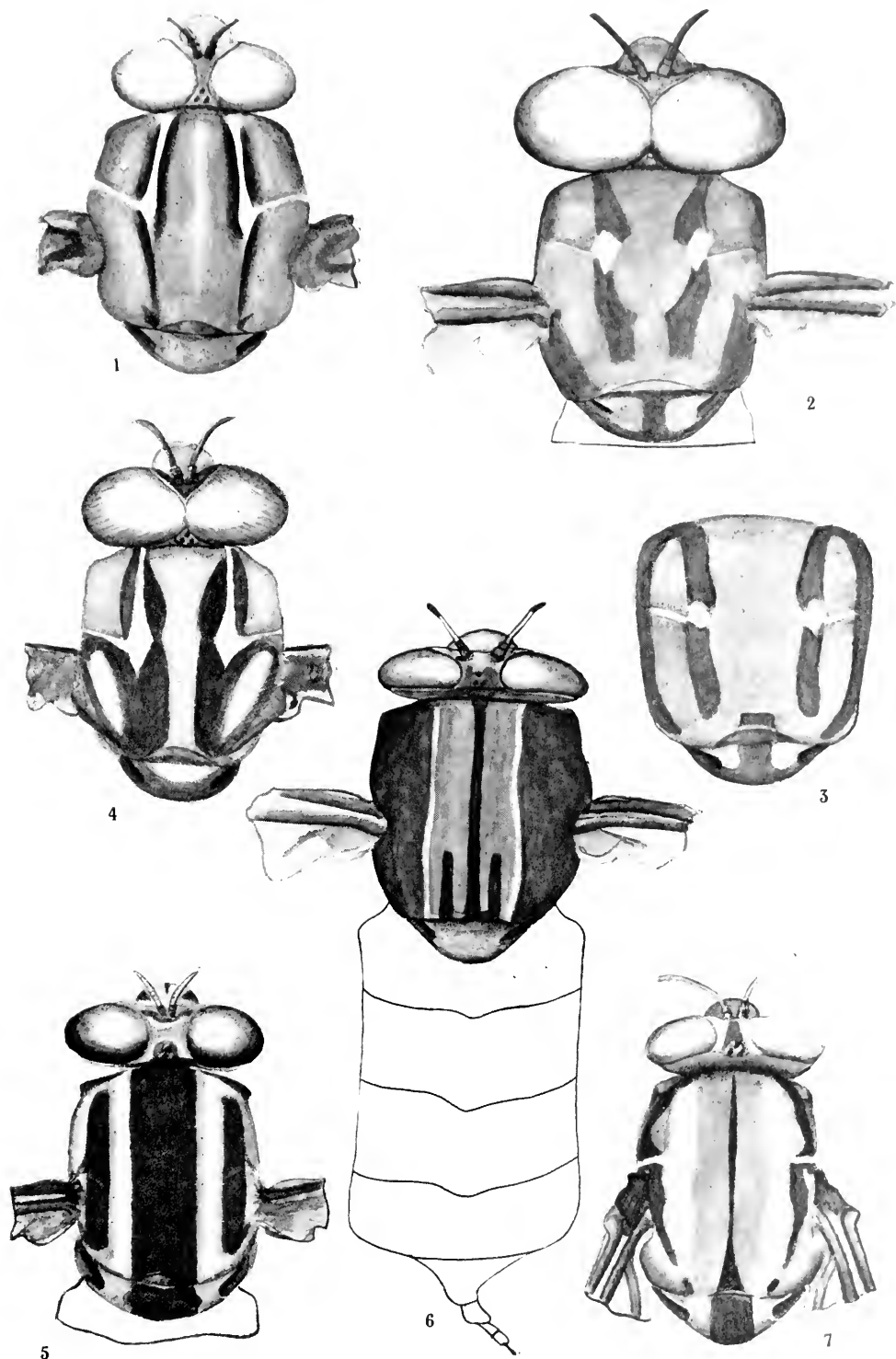
EXPLANATION OF PLATE IX.

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Illustrations of the thoracic marks in the genus *Pelecorhynchus*.

- Fig. 1. *P. igniculus*, Hardy, from the holotype, ♂.  
„ 2. *P. montanus*, Hardy, from the holotype, ♂.  
„ 3. *P. montanus*, var *a.*, Hardy, from the holotype, ♂.  
„ 4. *P. albolineatus*, Hardy, from the holotype, ♂.  
„ 5. *P. distinctus*, Taylor, from the holotype, ♀.  
„ 6. *P. tillgardi*, Taylor, from the holotype, ♀.  
„ 7. *P. deaqueti*, sp. nov., from the holotype, ♀.







# STUDIES IN AUSTRALIAN FISHES.

No. 6. \*

With a description of a new *Girelllops* from the Kermadec Islands

BY

ALLAN R. McCULLOCH, Zoologist, Australian Museum.

(Plates x-xiv.)

Family DASYATIDÆ.

Genus TAENIURA, *Müller & Henle*.

TAENIURA LYMMA, *Forsk.*

(Plate x.)

*Taeniura lyman*, Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 399  
—*cide* references and synonymy. *Id.*, Ogilby, Proc. Linn. Soc. N.S.  
Wales, x., 1885, p. 465, and Mem. Qld. Mus., i., 1912, p. 31, and v.,  
1916, p. 87.

Pectoral disc subcircular, longer than broad, its width 1.2 in its length; the snout and lateral margins are broadly rounded, but the posterior pectoral angles are pointed. Preocular length equal to the width between the angular projections on the upper margins of the spiracles. Eyes large, their bulge subequal in size to the spiracles, and to half the interspiracle width. Skin smooth; a series of flattened spines on the median line of the back extending backward almost to the level of the posterior insertion of the pectorals; these form an irregular double row before the shoulders, and there are one or two spines on each side of the median series on the shoulders themselves. Width of the mouth 1.4 in its distance from the end of the snout. Jaws undulous; teeth small and tessellate, with flattened points directed backwards; a series of larger pointed ones on each side of the upper jaw. A fringed velum behind the upper jaw, and two papillæ behind the lower. Nostrils elongate, each with a broad outer fold and a postero-interior valve; nasoral valve emarginate and fringed posteriorly. Posterior gill-opening well before the middle of the pectoral disc.

Ventrals elongate, their outer angles produced and their posterior margins rounded. Tail 0.6 longer than the body, with two spines inserted behind the middle of its length; upper surface grooved before the spines but keeled behind their tips; lower surface with a broad fin extending from before the base of the spines to the tip, which is about as broad as the tail above it.

*Colour*.—Tan brown above, with large blue spots irregularly scattered over the disc and ventral fins, which are mostly darker than the ground-colour in the preserved specimen though lighter in life. A broad blue stripe extends along each side of the tail from the back to behind the caudal spines. Lower surfaces uniformly light coloured.

\* For No. 5, see "Records," xii., pt. 8, 1919, p. 171.

Described and figured from a female example 229 mm. wide, from Murray Island.

*Variation*.—A larger specimen from St. Crispin Reef, only differs in having the blue spots lighter instead of darker than the ground-colour, and in having microscopic spinules imbedded in the skin on some parts of the back which can be felt with the finger. A smaller male from Port Darwin has the spots on the disc larger and blackish with indefinite lighter margins.

*Locs.*—Port Darwin, North Australia; coll. Christie & Godfrey. Murray Island, Torres Strait; coll. Hedley & McCulloch, October, 1907. St. Crispin Reef, off Port Douglas, Queensland; coll. McCulloch, June, 1919.

### Family CLUPEIDÆ.

#### Subfamily DUSSUMIERINÆ.

Genus *STOLEPHORUS*, *Lacépède*.

*STOLEPHORUS ROBUSTUS*, *Ogilby*.

Blue Sprat.

(Plate xi, fig 1.)

*Spratelloides robustus*, Ogilby, Proc. Linn. Soc. N.S.Wales, xxii, 1897, p. 64.

*Stolephorus robustus*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 12, and Rec. Austr. Mus., vi., 1906, p. 195. *Id.*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 5.

? *Spratelloides delicatulus*, Zeitz, Trans. Roy. Soc. S.Austr., xxxii., 1908, p. 295 (Not of Bennett).

D. 12; A. 11; P. 13; V. 8; C. 17. 45 scales between the upper angle of the operculum and the base of the tail; 8-9 between the origins of the dorsal and ventral fins, excluding the median series above and below; 14 scales on the middle line of the back before the dorsal fin.

Depth before the dorsal fin 5.1 in the length to the hypural joint; head 3.7 in the same. Eye equal to the length of the snout, 3.5 in the head. Interorbital space 1.1 in the eye. Depth of the caudal peduncle 3.1 in the head. Third dorsal ray 1.5, third anal ray 3.7, pectoral 1.6, ventral 2.1, and caudal 1.3 in the head.

Body moderately robust though laterally compressed, the ventral surface rounded like the back and without serrated scales; ventral profile more convex than that of the back. Snout obtusely pointed, the mandible scarcely projecting when the mouth is closed. Maxilla broad, reaching to below the anterior border of the eye; jaws and palate apparently toothless, tongue spatulate, free anteriorly. Nostrils close together, midway between the eye and the end of the snout. Eye large, with a well developed anterior and posterior adipose lid. Interorbital space flat. Upper surface of head, sides of snout, cheeks and operculum closely covered with large ramose canals, which also extend over the scapular region.

Scales large and regular, their borders minutely but distinctly lobulate. An elongate axillary scale above each pectoral and ventral fin, and enlarged scales cover the basal portions of the pectorals. Modified scales form an imperfect sheath at the base of the dorsal fin, and a more distinct one on the base of the anal. Base of caudal scaly, with the usual enlarged pinnate scales on each lobe.

Dorsal fin situated in a groove on the back, and commencing nearer the snout than the hypural joint; the first ray is about half as long as, and simple like the second; the third is longest and branched. First ventral ray inserted a little behind the middle of the dorsal base; it is simple and scarcely shorter than the second, and reaches almost half way to the vent when adpressed. Pectorals very low on the sides, and reaching half their distance from the ventrals. Anal with two simple rays anteriorly, the third longest. Caudal deeply forked.

*Colour*.—Dark bluish black on the back and upper portion of the sides, which colour forms a well defined line at its junction with the silver of the rest of the body, except on the caudal peduncle where it is more or less diffused. A dark oblique streak on the side of the snout in front of the eye, and a dark horse-shoe shaped mark on the base of the tail.

Described and figured from one of Ogilby's types which is 63 mm. long from the snout to the end of the middle caudal rays.

*Synonymy*.—I have compared specimens from Queensland, New South Wales, Victoria, and Tasmania, and can find no specific differences between them. It seems probable, therefore, that the examples from South Australia which were doubtfully identified by Zietz as *S. delicatulus* are properly referable to *S. robustus*.

*Locs*.—Numerous specimens of this species up to 83 mm. long are in the Australian Museum from near Sydney and Port Hacking, New South Wales. Two others are from Bulwer, Moreton Bay, Queensland; several from Queenscliff, Victoria; and a number of badly preserved specimens from Tasmania.

## FAMILY ENGRAULIDÆ.

### GENUS ENGRAULIS, *Curier*.

#### ENGRAULIS AUSTRALIS, *Shaw*.

#### Australian Anchovy.

(Plate xii, fig. 1.)

*Atherina australis*, Shaw, in White's Voy. N.S.Wales, 1790, p. 296 and plate opposite, fig. 1.

*Engraulis australis*, McCoy, Official Record, Intercolonial Exhib., Melbourne, 1866-7, p. 319

*Engraulis encrasicholus* var. *antipodum*, Günther, Brit. Mus. Cat. Fish., vii., 1868, p. 386. *Id.*, Hutton, Cat. Fish. N. Zeal., 1872, p. 62, and Trans. N. Zeal. Inst., v., 1873, p. 270. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), pp. 92 & 132, and 1890 (1891), p. 37. *Id.*, Kent, Nat. in Austr., 1897, p. 155.

*Engraulis commersonianus*, Günther (*acc.* Lacépède), Brit. Mus. Cat. Fish., vii., 1868, p. 388—part, suggested Australian identification (*Atherina australis*) only.

*Engraulis aulareticus*, Castelnau, Proc. Zool. Soc. Viet., i., 1872, p. 186. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, iv., 1879, p. 365, and vi., 1882, p. 257. *Id.*, Lucas, Proc. Roy. Soc. Viet. (2), ii., 1890, p. 37.

? *Engraulis heterolobus*, Klmzinger (*acc.* Rüppell), Arch. Naturg., xxxviii, i., 1872, p. 42, and Sitzb. Akad. Wiss. Wien, lxxx, i., 1879, p. 415—part, Victorian specimens. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, ix., 1884, p. 57—part, Victorian specimens. *Id.*, Lucas, Proc. Roy. Soc. Viet. (2), ii., 1890, p. 37.

*Engraulis australis*, Steindachner, Denkschr. Akad. Wiss. Wien, xli, i., 1879, p. 14.

*Engraulis antipodum*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 13. *Id.*, Stead, Ed. Fish. N.S.Wales, 1908, p. 28. *Id.*, Waite, Rec. Cantb. Mus., i., 1907, p. 9. *Id.*, Zietz, Trans. Roy. Soc. S.Austr., xxxii., 1908, p. 294. *Id.*, McCulloch, Rec. W.Austr. Mus., i, 3, 1914, p. 213.

D. 15; A. 17; P. 16; V. 7; C. 19; Br. 12. Depth before the ventrals 6.2 in the length to the hypural joint; head 3.6 in the same. Eye 3.9, snout 6.6 in the head. Longest dorsal rays 2.1, longest anal rays 3.3, upper pectoral ray 2.2, and first ventral ray 3.5 in the head. Base of the dorsal fin 2.5, and base of the anal fin 1.8 in the head.

Body elongate fusiform, robust, the width 1.4 in the depth; ventral surface scarcely carinate and without any projecting sentes. The scales are large, with entire edges; they commence on the nape above the gill-opening, and form sheaths at the bases of the dorsal and anal fins. (Most of the scales are missing in this specimen, so that the number cannot be counted, but other examples from the same locality retain traces of about forty in a longitudinal row). An elongate axillary scale at the base of each pectoral and ventral fin, and another between the latter fins; some enlarged scales cover the base of each pectoral, and three or four enlarged feather-like paired scales are superimposed above the bases of the inner caudal rays, the outer pair of which is largest.

Head naked, the greater part covered with a system of canals and pores opening on the surface, and which leave only the snout and mandible bare. Nostrils close together, and situated midway between the end of the snout and the anterior border of the eye. Mouth a little oblique; the maxilla is a little expanded posteriorly and reaches backward almost to the mandibular articulation, but not nearly to the preopercular margin. Mandible closing within the upper jaw and reaching forward to the vertical of the posterior nostril. Premaxillary with a row of fine cardiform teeth along its whole length, and each mandibular edge has a similar row

of smaller teeth; a row of microscopic teeth is present on each palatine bone, and a few are present on a raised ridge on each side of the vomer. Gill-membranes united across the isthmus anteriorly by a fine membrane. Gill-rakers slender, those at the angle of the first arch two-thirds as long as the eye; about thirty on the lower limb of the first arch.

First dorsal ray placed a trifle nearer the hypural joint than the end of the snout; the two anterior rays are simple, and the third is branched and longest, being longer than the base of the fin. Anal commencing behind the tip of the adpressed dorsal; its two anterior rays are simple, the third branched and longest though little more than half the length of the base of the fin. Ventral inserted before the dorsal, the origin of which is above the middle of its length when it is adpressed; its first ray is simple and longest, the others branched. Pectoral reaching more than half its distance from the ventral, its upper ray simple, the second branched and longest. Caudal forked.

*Colour*, after preservation in alcohol.—Brown on the back and upper portion of the side, with a broad silver lateral band from the shoulder to the tail; lower portions of the sides and head silvery.

Described and figured from a specimen 107 mm. long, from the end of the snout to the tip of the middle caudal rays, which was collected at Port Hacking, New South Wales.

*Variation*.—One other specimen of about the same size from Port Hacking, and four from the Melbourne Markets exhibit the following characters.

Locality.	Dorsal.	Anal.	Vertebrae.
Port Hacking ...	1+14	17	43
Victoria ...	15	18	45
" ...	15	19	45
" ...	16	19	44
" ...	1+15	19	43

*Status*.—*E. australis* is very similar to *E. eucaerasicolus*, Linné, but appears to have less numerous scales, there being only about 40 in a longitudinal row instead of 48-50.

*Synonymy*.—The common Anchovy of southern Australia and New Zealand appears to have been referred to under several different names by different authors.

The figure of *Atherina australis*, Shaw, which was accompanied by only a few characters of a general nature, is very crude, and cannot be associated with our species with certainty. The fact that it has but one dorsal fin excludes it from the Family Atherinidae in which it was placed

by its author, while its general appearance suggests that it is an Engraulid: this has been already noted by Cuvier and Valenciennes<sup>1</sup> who considered it possibly synonymous with *E. browni*, and by Günther<sup>2</sup> who included it with doubt in the synonymy of *E. commersonianus*. From White's journal, it is almost certain that all the species described by Shaw in the addendum to his work were taken between Botany Bay and Broken Bay, New South Wales: and as only one species of the family Engraulidae is known from this area, it is reasonable to assume that Shaw's figure represents that common species.

Günther's name *antipodum* was established to distinguish Tasmanian and New Zealand specimens which were regarded as mere varieties of *E. ennerasicolus*, Linné, having a few more anal rays than European representatives of the species. My Victorian specimens referred to above exhibit this characteristic, and leave no doubt that they belong to the same form as was discussed by Günther. This supposed difference is not constant, however, the number being subject to variation, and I find no specific differences between the Victorian specimens and the local examples I have identified as *E. australis*.

*Engraulis antarticus* was a name given by Castelnau to a species which was said to be very common in the Melbourne markets during the whole year about 1872. I have examined many Victorian specimens which differ from his description principally in having 18-19 instead of 12 anal rays and 7 instead of 6 ventral rays, but as they were purchased in the Melbourne markets in 1880 and 1886, they indicate that Castelnau's counting of the fin-rays was incorrect. Castelnau relied upon the presence of mandibular teeth and a silvery lateral band to distinguish his *antarticus* from *ennerasicolus*, in which these characters were said to be wanting by Günther, but I find both the teeth and the band are present in specimens of the European species, and quite similar to those of Australian examples.

*E. heterolobus*, Rüppell, is a tropical species, so that Klunzinger's records of it from Hobson's Bay are almost certainly incorrect. His Victorian specimens were perhaps identical with the form described above, which is apparently the only Engraulid occurring in the waters of that State, and references to his papers are accordingly included in the above synonymy.

Steindachner's brief description of his *E. australis* from Hobson's Bay was based upon small examples in bad condition. Such characters as were given agree with those of the specimens here described and figured, and I therefore regard Steindachner's species as synonymous with Shaw's variety of the same name.

*Occurrence*.—Though the Australian Anchovy is commonly said to be abundant in our waters, the records of its occurrence in large numbers are not very numerous. McCoy (1867) first observed the species in great

<sup>1</sup> Cuvier & Valenciennes, Hist. Nat. Poiss., 4to. ed., x., 1835, p. 313, and xxi., 1848, pp. 32 & 35.

<sup>2</sup> Günther, Brit. Mus. Cat. Fish., vii., 1868, p. 388.



abundance in Hobson's Bay, Victoria, and Castelnau later noted that it was common in the Melbourne markets during the whole year about 1872. According to Johnston, the Anchovy occurs in Tasmanian waters in vast shoals where it is preyed upon by Barraouta and Mackerel. He found it abundant between the years 1882 and 1890, and noted that it frequently entered the estuaries of the Derwent, Tamar, and Huon Rivers during the summer months. Stead (1908) noted that the species congregates in enormous shoals of surpassing magnitude on the coast of New South Wales, and he recorded such an occurrence in March, 1908. He added that Anchovies are always present on the coast of New South Wales where they frequent the deeper waters of our harbours, lakes, and estuaries. Ogilby (1908) observed that the species visits southern Queensland in large shoals during the winter months.

*Localities.*—Specimens having the same characters as the example described above are in the Australian Museum from various localities in south-western Australia, Tasmania, Victoria, and New South Wales. The species has further been recorded from South Australia, southern Queensland, and New Zealand.

## Family RETROPINNIDÆ.

### Genus RETROPINNA, Gill.

*Retropinna*, Gill, Proc. Acad. Nat. Sci. Philad., 1862, p. 14 (Orthotype *Argentina retropinna*, Richardson). *Id.*, Günther, Brit. Mus. Cat. Fish., vi., 1866, p. 171.

*Richardsonia*, Steindachner, Sitzb. Akad. Wiss. Wien, liii., 1866, p. 469 (Orthotype *Argentina retropinna*, Richardson).

*Jenynsellia*, Ogilby, Ann. Qld. Mus., No. 9, 1908, pp. 6, 7, 15 (Orthotype *J. weatherilli*, Ogilby).

General form elongate, the body covered with cycloid scales of moderate size; no true lateral line. Head naked with symmetrically placed open pores. Eyes rather large, mouth large, oblique; strong teeth are present on both jaws, on the vomer, palatines, and tongue, and on the mesopterygoid and basihyal. Gill-openings extending far forward, the membranes united with the isthmus; 5-6 branchiostegals. Dorsal fin placed far back, partly opposite the anal; a small adipose dorsal present above the end of the anal. Anal longer than the dorsal. Pectorals low down on the sides. Ventrals submedian, with six rays. A membrane commences on the ventral surface between the pectorals, and extends backward and increases in depth to the vent. Caudal forked. Vertebrae about 50.

*Distribution.*—Fresh waters and estuaries of New Zealand and Tasmania. Murray River drainage system in Victoria, South Australia, New South Wales, and south-eastern Queensland; also the Burnett River and coastal streams of southern Queensland and New South Wales.

The New Zealand and Tasmanian species descend to the estuaries to breed, and their young are captured, together with those of some species of *Gadarias*, and sold as Whitebait. This habit has not been noticed in the Australian species, though it is recorded that those inhabiting the coastal streams may be found in both fresh and salt water<sup>2</sup>. But it is evident that specimens living in the western rivers of New South Wales cannot get so far down as the sea to breed, and that their eggs must be deposited, and the young developed in the fresh water streams.

a. Scales larger, in 50-60 rows.

b. Vomerine and palatine teeth uniserial; New Zealand.....*retropinna*.

bb. Vomerine and palatine teeth partly biserial; Australia.....*semonii*.

aa. Scales smaller, in about 70 rows; Tasmania.....*tasmanica*.

### RETROPINNA RETROPINNA, *Richardson*.

#### New Zealand Smelt.

(Figs. 1-2.)

*Argentina retropinna*, Richardson, Ichth. "Erebus & Terror," 1848, p. 121, pl. lii., figs. 1-3. *Id.*, Powell, Trans. N.Zeal. Inst., ii., 1870, p. 84, pl. xvi., fig. 1.

*Retropinna richardsonii*, Gill, Proc. Acad. Nat. Sci. Philad., 1862, p. 14. *Id.*, Günther, Brit. Mus. Cat. Fish., vi., 1866, p. 171. *Id.*, Hector, Trans. N.Zeal. Inst., iii., 1871, p. 133, pl. xviii., fig. 3, and xxxv., 1903, p. 315. *Id.*, Hector, Fish. N.Zeal., 1872, p. 126. *Id.*, Hutton, Fish. N.Zeal., 1872, p. 58, pl. x., fig. 91, and Trans. N.Zeal. Inst., v., 1873, p. 270, and xxviii., 1896, p. 318. *Id.*, Gill, Mem. Nat. Acad. Sci., vi., 1893, p. 112. *Id.*, Hutton, Index Faun. N.Zeal., 1904, p. 51. *Richardsonia retropinna*, Kner, Zool. "Novara," iii., Fische iii., 1867, p. 318.

*Retropinna richardsonii*, var. *elongata*, Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx. i., 1879, p. 413.

*Retropinna osmeroides*, Hector, Trans. N.Zeal. Inst., iii., 1871, p. 134, pl. xix., fig. 1, and xxxv., 1903, p. 315. *Id.*, Fish. N.Zeal., 1872, p. 126.

*Retropinna retropinna*, Waite, Rec. Cantb. Mus., i., 1907, p. 10.

Characters of a specimen 52 mm. long to the hypural joint, without the tail, which was received from the British Museum and was labelled by Mr. C. Tate Regan as a "Cotype of *R. richardsonii*" (fig. 1).



Fig. 1. *Retropinna retropinna*. Cotype.

<sup>2</sup> Stead, Fish. Austr., 1906, p. 33.

Br. 5. D.  $3\frac{3}{8}$ ; A.  $3\frac{1}{17}$ ; P. 11; V. 6; C. 18. About 60 myomeres, of which the seventeenth descends to the ventral fin, and the thirty-sixth falls below the origin of the dorsal. About sixty scale-pits in a longitudinal row.

Depth before the ventrals 6·8 in the length to the hypural joint; head 4·6 in the same. Eye 3·2 in the head; snout 1·2 in the eye, and 1 in the head. Interocular space slightly greater than the length of the snout. First branched dorsal ray 1·8, first branched anal ray 2, pectoral 1·4, and ventral 1·8 in the head. Anal fin commencing below the middle of the dorsal base. Jaws subequal. Premaxillary teeth in a single row; a few teeth on the edge of the maxilla. Mandibular teeth in two rows anteriorly, uniserial laterally. Vomerine and palatine teeth in single rows; a row of large hooked teeth on each side of the tongue with some median ones posteriorly.

This specimen differs from Richardson's description in having the jaws equal, the mandibular teeth biserial anteriorly, and five instead of six branchiostegals.

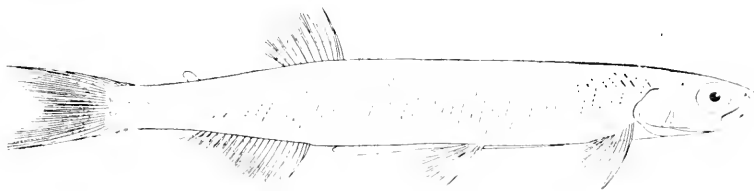


Fig. 2. *Retropinna retropinna*.

*Variation*.—A second New Zealand specimen (fig. 2) differs from the Cotype only in being rather more elongate. In other specimens the mandible projects well beyond the upper jaw as described and figured by Richardson. The dorsal rays vary from 11-13 in number, the anal from 18-20, and the pectoral from 9-12.

*Localities*.—Seventeen specimens, 50-78 mm. long, are in the Australian Museum from New Zealand, all of which are more or less imperfectly preserved. Three are from Lake Rotoiti, and one from Napier, North Island; coll. W. J. Phillips.

#### RETROPINNA SEMONI, Heber.

Australian Smelt.

(Plate xi., figs. 2, 3.)

*Richardsonia retropinna*, Steindachner, Sitzb. Akad. Wiss. Wien, liii., 1866, p. 469 (Not *Argentina retropinna*, Richardson).

*Retropinna richardsonii*, Macleay, Proc. Linn. Soc. N.S.Wales, vi., 1882, p. 228. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 55, and Proc. Linn. Soc. N.S.Wales, xxi., 1897, p. 727 (Not of Gill).

*Retropinna retropinna*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 13. *Id.*, Zietz, Trans. Roy. Soc. S.Austr., xxxii., 1908, p. 295 (Not of Richardson).

*Prototroctes semoni*, Weber, Zool. Forsch. Austr., v., 1895, p. 274.

*Jenynsella weatherilli*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 15.

*Jenynsella semoni*, Ogilby, Mem. Qld. Mus., i., 1912, p. 32.

*Retropinna semoni*, Ogilby, Mem. Qld. Mus., vi., 1918, p. 97.

Characters of a specimen of the typical form, 41 mm. long to the end of the middle caudal rays, from Ithaca Creek, near Brisbane, Queensland (Pl. xi., fig. 2).

D.  $2\frac{2}{8}$ ; A.  $3\frac{1}{12}$ ; P. 10; V. 6; C. 18. About 54 scales in a longitudinal row; about 48 myomeres, the fifteenth descending to the ventrals, and the twenty-ninth falling below the origin of the dorsal. Depth before the ventral fins  $5\frac{1}{4}$  in the length to the hypural joint; head  $4\cdot02$  in the same. Eye  $3\cdot2$  in the head; snout  $1\cdot5$  in the eye, and  $4\cdot5$  in the head. Interocular space slightly greater than the length of the snout. First branched dorsal ray 2, first branched anal ray  $1\cdot9$ , pectoral  $1\cdot5$ , and ventral  $2\cdot1$  in the head. Mandible just closing within the upper jaw. Similar in all structural details to the specimen described below.

Description of a specimen 55 mm. long from the snout to the end of the middle caudal rays, from Sackville, Hawkesbury River, New South Wales, in which the anal rays are more numerous than in the typical form (Pl. xi., fig. 3).

D.  $3\frac{3}{8}$ ; A.  $4\frac{1}{15}$ ; P. 11; V. 6; C. 18. About 52 myomeres, and about the same number of scale-rows between the shoulder and the hypural joint. Vertebrae 50. Depth before the ventrals 6 in the length to the hypural joint; head  $4\cdot7$  in the same. Eye  $3\cdot2$  in the head; snout  $1\cdot4$  in the eye, and  $4\cdot6$  in the head. Interocular space slightly greater than the length of the snout. First branched dorsal and anal rays  $1\cdot9$ , pectoral  $1\cdot5$ , and ventral  $1\cdot6$  in the head.

General form moderately elongate, compressed, the dorsal and ventral profiles almost evenly rounded; the adipose membrane on the ventral surface makes its appearance between the tips of the pectorals, and extends backward between the ventrals, reaching its greatest depth before the vent, where it terminates abruptly. Greater portion of the body covered with concentrically striated, cycloid scales of moderate size, but these are wanting on the breast and anterior portion of the abdomen beneath the pectorals; they are rather irregular in their arrangement; they extend onto the base of the caudal fin, but the remaining fins and the ventral membrane are naked. No true lateral line, but the junction of the angles of the myomeres is marked by a pigmented line extending from the shoulder to the hypural joint beneath the scales.

Head rather small, naked, with large open pores arranged regularly on the nape, preoperculum, preorbital and mandible. Snout rounded, the mandible projecting slightly when the mouth is closed. Maxilla broad, its obtuse point reaching backward to below the end of the first

third of the eye. Nostrils large, close together, and situated about midway between the eye and the end of the snout; the anterior with a low raised margin, and a thick lobe separating it from the posterior. Preopercular angle rounded, with a large pore on its border. Operculum and suboperculum with rounded margins and a broad free membranous border. Gill-openings extending forward to below the anterior portion of the eye, the membranes united with, but overlapping across the isthmus. Five broad branchiostegals. Teeth (of a specimen of similar size, and collected with the specimen described and figured) cardiform and curved; those in the premaxillaries are smallest and uniserial; no teeth on the maxillary edge. Mandibular teeth a little larger, in two rows anteriorly, but becoming smaller and uniserial on the sides; a curved band of teeth across the vomer, the outer teeth being largest and in two rows, while the median ones are smaller and uniserial; palatine teeth largest anteriorly and in two rows, becoming smaller and uniserial posteriorly; a patch of teeth on each mesopterygoid; lingual teeth largest of all, hooked and arranged in a single row on each side of the tongue, the rows meeting anteriorly and posteriorly, and there are a few mesial teeth at the back of the tongue; a broad elongate patch of teeth on the basihyal.

Dorsal fin higher than long, its origin a little in advance of the vertical of the vent; the first three rays are simple, the others branched. Adipose dorsal small, originating a trifle behind the vertical of the base of the last anal ray. Anal commencing in advance of the middle of the dorsal base, the tip of its last ray reaching beyond the base of the adipose dorsal; the four first rays are simple, the remainder branched; the first branched ray is longest and equal to that of the dorsal in length. Pectoral placed very low on the body, rounded, its inner and outer rays simple, the others branched; it extends much more than half its distance from the ventral. Ventrals large and rounded, the first ray inserted a little nearer the snout than the last anal ray; the outer ray is thickened but branched, only the inner one being simple. Caudal forked.

*Colour*.—Almost uniformly light coloured in alcohol, the operculum silvery; cranium dark, and some blackish dots on the snout, lips, and back; a dark patch at the base of the tail, and a pigmented line along the sides to the shoulders. In life, this species is translucent green, with the eye, opercles, and the whole abdominal region silver; a median silvery iridescent band extends along the side of the tail; scales of the back margined with black dots; top of head black, and a black spot at the base of the tail.

*Status*.—*R. semoni* differs from the New Zealand *R. retropinna* in having some of the vomerine and palatine teeth arranged in two rows instead of a single series; it has also only about fifty instead of sixty scales in a longitudinal row. In all other details, however, the two are very similar.

*Variation*.—An examination of a large number of specimens from numerous localities shows that this species varies considerably in several of its characters. This variation is correlated to a certain extent with

the distribution of the species, examples from Queensland, for example, generally having fewer anal rays than others from New South Wales. Were this correlation well maintained the species might be subdivided into geographical races; but it is not consistent, and I have examples from near Sydney which appear to be similar in all details with others from the Burnett River. The following table illustrates the variation of several characters in thirty-seven specimens from seven different localities.

Locality.	No.	Dorsal.	Anal.	Ventral.	Pectoral.	Caudal.	Anal origin below.
Eidsvold ...	1	9	14 (15)	6	8	18	Middle of dorsal.
"	1	9	14 (15)	6	9	—	Ant. half of dorsal.
Ithaca Creek ...	1	10	15	6	10	18	Ant. part of dorsal.
Noosa River ...	1	9	15	6	9	18	Ant. half of dorsal.
Rylstone ...	1	10	15	6	9	—	—
Eidsvold ...	1	10	16	6	9	—	Ant. part of dorsal.
Rylstone ...	2	9	16	6	10	—	—
"	1	10	16	6	9	—	—
Duck Creek ...	1	10	16	6	10	18	Ant. part of dorsal.
Hawkesbury R.	1	10	16	6	9	—	—
Darling R. ...	1	10 (11)	15 (16)	6	12	18	Middle of dorsal.
"	1	11	16 (17)	6	10	18	Middle of dorsal.
Eidsvold ...	1	9	17	6	9	18	Ant. part of dorsal.
Darling R. ...	1	10	17	6	11	18	Middle of dorsal.
"	1	9	17 (18)	6	11	18	Middle of dorsal.
"	1	10 (11)	17 (18)	6	11	18	Middle of dorsal.
Rylstone ...	2	10	17	6	10	—	—
Hawkesbury R.	1	10	17	6	10	—	—
"	2	11	17	6	10	—	—
"	2	10	17	6	9	—	—
Darling R. ...	1	10	18	6	10	20	Middle of dorsal.
Hawkesbury R.	1	11	18	6	8	—	—
"	5	11	18	6	10	—	—
"	1	10	18	6	9	—	—
"	1	10	18	6	10	—	—
"	1	11	19	6	10	—	—
"	2	11	20	6	10	—	—
"	1	11	20	6	11	—	—

*Localities.*—Series of specimens in greater or lesser numbers are in the Australian Museum from the following localities:—Eidsvold, Burnett River, Queensland; coll. Dr. T. L. Bancroft. Head waters of Noosa River, and Ithaca Creek, near Brisbane; coll. J. Douglas Ogilby. Rylstone, Cudgegong River, New South Wales; coll. D. G. Stead. Horton River, near Bingara, New South Wales; coll. A. R. McCulloch. Darling River, between Wilcannia and Bonrke, New South Wales; coll. R. Helms. Murrumbidgee River, near Narrandera, New South Wales; coll. D. G. Stead. Hastings River, near Beechwood, New South Wales; coll. A. R. McCulloch. Glenbrook Creek, junction of the Grose and Nepean Rivers, and Sackville, Hawkesbury River; coll. A. R. McCulloch. Duck Creek, at Clyde, New South Wales; coll. A. R. McCulloch.



Fig. 3. Distribution of *Retropinna semoni*.

*Distribution.*—*R. semoni* was originally described from the Burnett River, Queensland, and I have examined several specimens from various localities in south-eastern Queensland. It also extends over the whole area drained by the Murray River system; numerous specimens are in the Australian Museum from various widely separated localities in western New South Wales, while it has also been recorded from Pyramid Hill, Victoria, by Ogilby, and from Lake Alexandrina, South Australia, by Zietz. The species further occurs in the coastal rivers of New South Wales at least as far south as Sydney, and I have collected many specimens both in the Hastings River and in various tributaries of the Hawkesbury near Sydney.

RETROPINNA TASMANICA, *sp. nov.*

Tasmanian Smelt.

(Plate xi., fig. 4.)

*Retropinna richardsonii*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), pp. 62, 128, and 1890 (1891), p. 36 (Not *R. richardsonii*, Gill).

D. 3/8; A. 3 16; V. 6; P. 10; C. 18. Scales mostly missing from the holotype, though there are indications of about 74 rows between the operculum and the hypural joint. (Other Tasmanian specimens in which the scales are attached, have about 70 rows).

Depth before the ventral fins 6·3 in the length to the hypural joint; head 5 in the same. Eye 3·2 in the head; snout 1·3 in the eye, and 4·3 in the head. Interocular width slightly greater than the length of the snout. First branched dorsal and anal rays 1·8, ventral fin 1·6, and pectoral fin 1·4 in the head.

Anal commencing below the anterior portion of the dorsal fin. Basal portion of the ventral membrane covered with small scales. Jaws subequal. Premaxillary teeth in a single row. Mandibular teeth in two rows anteriorly, uniserial posteriorly. Vomerine teeth in two rows, palatines apparently uniserial (they are biserial anteriorly in a larger specimen received with the holotype). A single row of teeth on each side of the tongue, with some scattered median ones between them posteriorly.

Described and figured from a specimen 67 mm. long to the end of the middle caudal rays, from the Huon River.

*Variation*.—The palatine and vomerine teeth of Tasmanian specimens may be arranged in either one or two rows. The scales are apparently variable in number, but seem to be always in seventy or more rows. In eleven specimens the fin-rays vary as follow:—D. 11-12; A. 17-21; P. 9-11; V. 6.

*Status*.—This species differs from *R. semoni* in its squamation, there being about seventy rows of scales instead of about fifty; they are also more developed on the nape and thoracic regions, and are distinct on the basal portion of the ventral membrane. The increased number of scales also distinguishes *R. tasmanica* from *R. retropinna*.

*Localities*.—Thirteen specimens are in the Australian Museum from the Huon River, and the neighbourhood of Hobart, Tasmania.

## Family KUHLLIDÆ.

Genus KULLIA, *Gill*.

*Dules* (part). Cuvier and Valenciennes, Hist. Nat. Poiss., iii., 1829, p. 111. *Id.*, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 266.

*Kullia*, Gill, Proc. Acad. Nat. Sci. Philad., 1861, p. 48 (*Perca ciliata*, Cuv. and Val.). *Id.*, Boulenger, Brit. Mus. Cat. Fish. (2nd ed.), i., 1895, p. 35. *Id.*, Regan, Proc. Zool. Soc., 1913, p. 374.



*Moronopsis*, Gill, Proc. Acad. Nat. Sci. Philad., 1863, p. 82 (*Dules marginatus*, Cuv. and Val.).

*Paradules*, Bleeker, Nederl. Tijd. Dierk., i., 1863, p. 257.

*Herops*, De Vis, Proc. Linn. Soc. N.S.Wales, ix., 1884, p. 392 (*H. munda*, De Vis).

*Boulengerina*, Fowler, Proc. Acad. Nat. Sci. Philad., 1906, p. 512 (*Dules mato*, Lesson)—not of Dollo, 1886.

*Safole*, Jordan, Proc. U.S. Nat. Mus., xlii., 1912, p. 655 (*Dules tenuis*, Cuv. and Val.).

An examination of a cotype of *Herops munda*, De Vis, proves it to be a species of *Kuhlia*, so that the synonymy of this genus must be rendered as above.

#### KUHLIA MUNDA, De Vis.

*Herops munda*, De Vis, Proc. Linn. Soc. N.S.Wales, ix., 1884, p. 392.

*Dules humilis*, De Vis. *Ibid.*, p. 396.

*Kuhlia humilis*, Ogilby, Ann. Qld. Mus., No. 10, 1911, p. 46, pl. vi., fig. 1. *Id.*, Regan, Proc. Zool. Soc., 1913, p. 380, fig. 69a.

*Dules nitens*, Ramsay and Ogilby, Proc. Linn. Soc. N.S.Wales (2), ii., 1887, p. 4. *Id.*, Regan, Proc. Zool. Soc., 1914, p. 340.

*Kuhlia malo* (part), Boulenger, Brit. Mus. Cat. Fish. (2nd ed.), i., 1895, p. 40—not of Cuvier and Valenciennes.

*Kuhlia proxima*, Kendall and Goldsborough, Mem. Mus. Comp. Zool., xxvi., 1911, p. 282, pl. iii., fig. 2.

*Synonymy*.—An example 126 mm. long from the snout to the end of the middle caudal rays, is in the Australian Museum, labelled as "*Dules munda*; Cardwell." It was received from Mr. De Vis by Mr. Ogilby in 1886, and as it agrees in all details with the description of *Herops munda*, De Vis, it is evidently a cotype of that species. This specimen only differs from Ogilby's description and figure of *Kuhlia humilis*, De Vis, in having the eye somewhat larger, it being 2.36 in the length of the head, less the mandible, instead of 2.75; the two species are therefore apparently synonymous. I have further compared it with the holotype of *Kuhlia nitens*, Ramsay and Ogilby, which is 236 mm. long, and have found it similar in all structural details; some slight differences in the proportions of the eyes, head, and depth are evidently due to the different sizes of the two specimens.

I am indebted to Mr. Ogilby for the suggestion as to the identity of De Vis's puzzling genus.

*Loc.*—Cardwell, Queensland; cotype of *Herops munda*. Port Moresby, New Guinea; holotype of *Dules nitens*.

## Family KYPHOSIDÆ.

Genus KYPHOSUS, *Lacépède*.

## Key to the Australian species:—

- a.* Anterior dorsal rays distinctly higher than the longest spines.  
*b.* About 52 scales in a row between the supraclavicle and the hypural joint.....*cinerascens*.  
*aa.* Median dorsal spines longer than the rays.  
*c.* D. xi/12, A. iii/11.  
*d.* L. lat. about 55.....*sydneyanus*.  
*dd.* L. lat. about 66 (Klunzinger).....*indicus*, Klunz.  
*ce.* D. xi/13, A. iii/12; l. lat. 54.....*gibsoni*.

KYPHOSUS INDICUS (*Cur. and Val.?*), Klunzinger.

*Pimelepterus indicus*, Klunzinger, Sitzb. Akad. Wiss. Wien., lxxx. i., 1879, p. 357, pl. vii. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, ix., 1884, p. 15 (Perhaps not *P. indicus*, Cuv. and Val.).

*Pimelepterus fallax* (part), Klunzinger, Fisch. Roth. Meeres, i., 1884, p. 64—Australian specimens.

The identity of the specimen from King George's Sound, characterised and figured by Klunzinger, remains uncertain. He counted about 66 scales on the lateral line, but his figure shows only 53 pierced scales; it also shows about 54 rows between the supraclavicle margin and the hypural joint. The illustration was prepared by Eduard Konopicky, however, whose work is notable for its accuracy, which suggests that Klunzinger may have counted the scales incorrectly. The specimen is possibly a rather slender example of *K. sydneyanus*, Günther, which species has been recorded from Western Australian waters.

## KYPHOSUS SYDNEYANUS, Günther.

## Silver Drummer.

(Pl. xii., fig. 2).

*Pachymelopon grande*, Macleay, Proc. Linn. Soc. N.S.Wales, v., 1882, p. 406. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 17 (Not of Günther).

*Pimelepterus sydneyanus*, Günther, Ann. Mag. Nat. Hist. (5), xviii., 1886, p. 368. *Id.*, Ogilby, Ed. Fish. N.S.Wales, 1893, p. 40, pl. xvi.

*Pimelepterus meridionalis*, Ogilby, Proc. Zool. Soc. Lond., 1886, p. 539.

*Kyphosus sydneyanus*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 26. *Id.*, Stead, Ed. Fish. N.S.Wales, 1908, p. 53. *Id.*, Zietz, Tr. Roy. Soc. S.Austr., xxxiii., 1909, p. 267. *Id.*, Waite, Rec. Cantb. Mus., i. 4, 1912, p. 319, and Tr. N.Zeal. Inst., xlv., 1913, p. 219. *Id.*, McNulloch, Rec. W.Austr. Mus., i. 3, 1914, p. 219.

*Pimblepterus drevii*, Hector, Tr. N.Zeal. Inst., xix., 1887, p. 590.

*Nomen nudum*.

D. xi/12; A. iii/11; P. 18; V. i/5; C. 17. 55 pierced scales on the lateral line, of which five are beyond the hypural joint. About 63 rows of scales above the lateral line between its origin and the hypural joint, of which the anterior ones are very irregular; 52 rows between the posterior margin of the supracleivale and the hypural joint. 10 scales between the origin of the dorsal fin and the lateral line, and 20 more to the ventral surface.

Depth before the ventrals 2.1 in the length to the hypural joint; head 3.6 in the same. Breadth at the pectoral bases 2.5 in the depth. Eye shorter than the snout, 1.7 in the interorbital space, and 3.9 in the head. Interorbital width 2.1, and snout 3 in the head. Depth of the caudal peduncle 1.4 in its length, and 2.1 in the head. Sixth dorsal spine 2.9, second dorsal ray 2.4, and pectoral 1.5 in the head.

Body broadly elliptical, compressed, the upper and lower profiles almost equally arched. Head obtuse, almost as deep as long; the snout is very convex before the eyes, but thence the profile rises evenly to the origin of the dorsal. Eye almost entirely in the anterior half of the head, and well below the upper profile; interorbital space convex. Preorbital, snout, and lips naked, the rest of the head covered with strongly ctenoid scales. Preorbital and preoperculum serrated; two weak opercular spines. Nostrils approximate, near the eye, with low skinny margins. Maxillary scaly, just reaching the vertical of the anterior orbital margin; jaws equal. Teeth in a single row in each jaw; the horizontal and vertical portions of the median premaxillary teeth subequal in length. An angular patch of minute teeth on the vomer, and a very small patch on the anterior part of each palatine; a very broad patch on each pterygoid, and a broad curved patch on the anterior part of the tongue.

Body entirely covered with strongly ctenoid scales, which also extend over the greater portion of all the rayed fins, and form sheaths at the bases of the dorsal and anal spines. Lateral line following the curve of the back. Post-temporal bone serrated.

Dorsal commencing a little behind the vertical of the ventral spine; the margin of the spinous portion is evenly arched, and the sixth spine is longest and much longer than the anterior rays. Soft dorsal much shorter than the spinous portion; its margin is almost straight, and the rays decrease in length backward. Anal a little farther back than the soft dorsal; the second and third spines are subequal, and the anterior rays are distinctly higher than those of the dorsal. Pectoral short and broad, the fifth ray longest, the margin rounded. Ventrals reaching about two-thirds of their distance from the vent. Caudal deeply emarginate, the lobes pointed.

*Colour*.—Dark silver, with longitudinal stripes extending along the sides between each row of scales. Head silver and bronze; a bronze stripe across the eye and another across the cheek, between which is a brilliant silver area. Opercular margin blackish. First dorsal olive-black, the other vertical fins lighter though dark towards their margins. A blackish spot beneath the pectoral at the lower angle of its base.

Described and figured from a specimen 245 mm. long, captured near Sydney by Mr. F. McNeill.

*Variation*.—This young example differs considerably in its general form from larger examples 770 mm. in length; in these the depth is only one-third of the length to the hypural joint, but specimens of intermediate size indicate that this is merely growth variation. Owing to the fact that the scales of the anterior portion of the body are very irregularly arranged, it is not possible to satisfactorily count the number of rows, but some specimens have more numerous scales than others, there being between 48 and 52 in a row between the posterior margin of the supraclavicle and the hypural joint.

*Synonymy*.—The name *Pimelepterus sydneyanus* was based upon a large stuffed example from Port Jackson, thirty inches long, which, according to Günther's description, had 67 scales on the lateral line and only 11 dorsal rays. In both these characters it differs from similarly large specimens in the Australian Museum from the same locality, which have 54-55 pierced scales on the lateral line and 12 dorsal rays. Mr. C. Tate Regan has re-examined Günther's type for me, however, and counts 55 pierced scales on the lateral line, 54 in a row between the supraclavicle and the hypural joint, and 12 dorsal rays, which disposes of the discrepancy.

*Pimelepterus meridionalis* also was described by Ogilby from large examples taken in Port Jackson, but its author later relegated it to the synonymy of *P. sydneyanus*; as no specimens now in the Australian Museum are labelled as *P. meridionalis*, and as the typical examples cannot be identified, this synonymy cannot be proved, but since there appears to be only one large species of the genus occurring in Port Jackson, it is almost certain that the names *P. sydneyanus* and *P. meridionalis* apply to the same fish.

The name *P. drevii*, Hector, was based on a New Zealand specimen now preserved in the Dominion Museum, Wellington. Gill<sup>4</sup> included this name in the synonymy of *Incisidens simplex*, but some details of the characters of the type, forwarded to me by Mr. W. J. Phillipps, indicate its identity with *K. sydneyanus*.

*Habits*.—According to Mr. McNeill, large examples of this fish appear close inshore on the coast near Sydney about the middle of September, when they are captured by rod-fishermen; they disappear again at the end of the summer, but small specimens may be captured throughout the winter. Their arrival is coincident with the appearance of a brown coloured seaweed<sup>5</sup> which covers the rocks near the low-water level, and upon which they feed. If handfuls of the weed be thrown into the water, the fish may often be observed to rise at it as it drifts from the rocks with such avidity that they partly expose themselves above the surface, and so leave no doubt as to their identity. The same weed is used to bait hooks for the capture of the larger specimens, though

<sup>4</sup> Gill—Mem. Nat. Acad. Sc. Wash., vi., 1893, p. 116.

<sup>5</sup> Identified by Mr. A. H. S. Lucas as *Wildemanian laciniata*, which is cooked and eaten by people living on the Scotch Coast.

a prawn will serve to attract smaller examples when it is not available during the winter months. Unless specially treated, the larger specimens are almost worthless as food, being very tough and of unpleasant flavour, but smaller examples are quite as tasty as the Blackfishes of the related family Girellidæ. Mr. McNeill has observed the species commonly off the coast near Sydney, and of all sizes between four inches and two feet in length.

*Locs.*—Four specimens are preserved in the Australian Museum from near Sydney, and one has been recently received from Mr. Edgar R. Waite which was taken in South Australian waters. The species has been recorded from Western Australia, South Australia, New South Wales, and New Zealand.

#### KYPHOSUS CINERASCENS, *Forsk.*

*Pimblepterus cinerascens* (Forsk.) Day, Fish. India, 1875, p. 143, pl. xxxv., fig. 3. *Id.*, Bleeker, Atlas Ichth., ix., 1876, p. 15, pl. cccclxiv., fig. 4. *Id.*, Günther, Ann. Mag. Nat. Hist. (5), xviii., 1886, p. 368.

*Pachymetopon squamosum*, Alleyne & Macleay, Proc. Linn. Soc. N.S.Wales, i., 1877, p. 275, pl. ix., fig. 1. *Id.*, Macleay, *Loc. cit.*, v., 1881, p. 407, and vii., 1887, p. 246, and ix., p. 16.

*Scorpiis vinosa*, Alleyne & Macleay, Proc. Linn. Soc. N.S.Wales, i., 1877, p. 277, pl. ix., fig. 2. *Id.*, Macleay, *Loc. cit.*, v., 1881, 398. *Id.*, Vaillant, Bull. Mus. Hist. Nat., iii., 1897, pp. 85-87.

*Kyphosus cinerascens*, Cockerell, Mem. Qld. Mus., ii., 1913, p. 57. *Id.*, Ogilby, Mem. Qld. Mus., ii., 1913, p. 90. *Id.*, McCulloch, Rec. Austr. Mus., xi. 7, 1917, p. 181.

A fine specimen of this species 365 mm. long, was secured on St. Crispin Reef on the outer edge of the great Barrier Reef, off Port Douglas, in June, 1918. It was feeding with several others on the reef at low tide, in water about 12 inches deep, and was speared by a native fisherman, who called it a Bream. It was a light silvery blue in colour, with two vertical bands posteriorly, the first between the anterior portions of the dorsal and anal, and the second between the posterior insertions of those fins.

A second specimen in the Australian Museum, 267 mm. long, from Port Moresby, was identified by Macleay as *Pachymetopon squamosum*, which species has already been recognised as synonymous with *K. cinerascens*. It agrees with the larger specimen in all details, and both agree with Bleeker's description and figure of the species.

#### KYPHOSUS GIBSONI, *Ogilby*.

(Plate xii., fig. 3).

*Kyphosus gibsoni*, Ogilby, Mem. Qld. Mus., i., 1912, p. 50.

D. xi/13; A. iii/12; P. 19; V. i/5; C. 15. 59 pierced scales on the lateral line, of which 6 are behind the hypural joint. About 75 rows of

scales above the lateral line between its origin and the hypural joint; 62 rows between the posterior margin of the supraclavicle and the hypural joint. 12 scales between the origin of the dorsal fin and the lateral line, and 21 more to the ventral surface.

Depth before the ventrals 2·6 in the length to the hypural joint; head 4·08 in the same. Breadth at the bases of the pectorals 2·1 in the depth. Eye 1·1 in the snout, 1·8 in the interorbital space, and 4·3 in the head. Interorbital width 2·3, snout 3·7 in the head. Depth of the caudal peduncle 1·7 in its length, and 2·4 in the head. Sixth dorsal spine 2·3, first dorsal ray 2·7, and pectoral fin 1·6 in the head.

Total length, from the snout to the end of the middle caudal rays, 387 mm.

The above characters and the accompanying figure are taken from the holotype of the species, which has been kindly lent to me for the purpose by the Director of the Queensland Museum.

*Loc.*—Moreton Bay, Queensland.

### Family GIRELLIDÆ.

Key to the Australian, New Zealand, and Kermadec Island Genera.

- a.* An inner series of flattened teeth in each jaw arranged in a broad band.
  - b.* Operculum largely naked.
    - c.* Scales larger, 49-58 in a longitudinal row; outer teeth in 1-4 rows, with trenchant or tricuspid edges..... *Girella*.
    - cc.* Scales small, about 90 in a longitudinal row; outer teeth in a single row, tricuspid..... *Tephrocops*.
  - bb.* Operculum scaly.
    - d.* Scales small, about 80 in a longitudinal row; outer teeth in a single row, tricuspid..... *Melambaphes*.
- aa.* Inner series of jaw-teeth absent or scarcely developed; cylindrical and pointed if present.
  - e.* Scales small, about 70 in a longitudinal row, with trenchant or tricuspid edges..... *Girellops*.

### GIRELLA, Gray.

Key to the Australian species.—

- a.* Outer teeth of the jaws imbricate, in 2-4 rows, simple or tricuspid; 14-16 dorsal spines; 49-52 rows of scales between the scapula and the hypural joint.
  - b.* Body uniformly coloured or with about 11 dark vertical bands; nostril but little fimbriate..... *Tricuspidata*.
  - bb.* A pale vertical band from the back to the belly..... *Zonata*.
- aa.* Outer teeth of the jaws in a single row, tricuspid; 50-58 scales between the scapula and the hypural.
  - c.* 14-16 dorsal spines; nostrils scarcely fimbriate; tail more or less emarginate..... *Eganea*.
  - cc.* 13 dorsal spines; nostrils markedly fimbriate; tail subtruncate..... *Elevata*.

### GIRELLA TRICUSPIDATA, Quoy & Gaimard.

#### Blackfish.

(Plate xiv, fig. 1).

*Box tricuspidatus*, Quoy & Gaimard, Voy. Uranie, 1824, p. 296.

*Oblata tricuspidata*, Cuvier & Valenciennes, Hist. Nat. Poiss., vi., 1830, p. 372.

- Crenideus triglyphus*, Richardson, Ichth. Erebus & Terror, 1845, p. 36, pl. xxv., fig. 2.
- Crenideus simplex*, Richardson, *Ibid.*, 1848, p. 120.
- Girella tricuspidata*, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 428, and Ann. Mag. Nat. Hist. (3), xx., 1867, p. 59. *Id.*, Steindachner, Sitzb. Akad. Wiss. Wien, lvi. i., 1867, p. 324. *Id.*, Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx. i., 1879, p. 355. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, v., 1881, p. 407. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1881 (1882), p. 111, and 1890 (1891), p. 30. *Id.*, Woods, Fish. & Fisher. N.S.Wales, 1882, p. 39, pl. vii. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 18. *Id.*, Lucas, Proc. Roy. Soc. Vict. (2), ii., 1890, p. 20. *Id.*, Ogilby, Ed. Fish. N.S.Wales, 1893, p. 42, pl. xii. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 26. *Id.*, Stead, Ed. Fish. N.S.Wales, 1908, p. 49, pl. xix. *Id.*, Roughley, Fish. Austr., 1916, p. 52, pl. xii.
- Girella simplex*, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 429. *Id.*, Kner, Reise Novara, Zool., i., 1865, p. 75. *Id.*, Steindachner, Sitzb. Akad. Wiss. Wien, lvi. i., 1867, p. 323, pl. i., fig. 3 (teeth). *Id.*, Klunzinger, Arch. Naturg., xxxviii. i., 1872, p. 22, and Sitzb. Akad. Wiss. Wien, lxxx. i., 1879, p. 355. *Id.*, Hector, Trans. N.Zeal. Inst., ix., 1877, p. 468, pl. viii., fig. 6c. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, v., 1881, p. 407. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 111, and 1890 (1891), p. 30. *Id.*, McCoy, Prodr. Zool. Vict., dec. viii., 1883, pl. lxxiii. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 18. *Id.*, Lucas, Proc. Roy. Soc. Vict. (2), ii., 1890, p. 20. *Id.*, Sherrin, Handb. N. Zeal. Fish., 1886, p. 71. *Id.*, Kent, Gt. Barrier Reef, 1893, pp. 285, 369. *Id.*, Ogilby, Ed. Fish. N.S.Wales, 1893, p. 44. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 26, and Rec. Cantb. Mus., i., 1907, p. 21.
- Melanichthys tricuspidata*, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 67, and Proc. Linn. Soc. N.S.Wales, iii., 1879, pp. 350, 363.
- Melanichthys simplex*, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 68, and ii., 1873, p. 41, and Proc. Linn. Soc. N.S.Wales, iii., 1879, pp. 350, 363.
- Incisidens simplex*, Gill, Mem. Nat. Acad. Sci. Wash., vi., 1893, p. 116.
- Melanichthys blackii*, Castelnau, Proc. Zool. Soc. Vict., ii., 1873, p. 41.
- Utenolabrus? knoxi*, Hutton, Trans. N.Z. Inst., v., 1873, p. 265, pl. x. *Id.*, Knox, *Ibid.*, p. 308. *Id.*, Hector, *Ibid.*, vii., 1875, p. 249.
- Girella percoides*, Hector, Trans. N.Z. Inst., vii., 1875, p. 243, pl. x., fig. 6d.
- Girella blackii*, Macleay, Proc. Linn. Soc. N.S.Wales, v., 1881, p. 408.
- Girella ramsayi*, Macleay, *Ibid.*, p. 409. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 18. *Id.*, Lucas, Proc. Roy. Soc. Vict. (2), ii., 1890, p. 20.
- ? *Girella carbonaria*, De Vis, Proc. Linn. Soc. N.S.Wales, viii., 1883, p. 283.
- Girella mentalis*, De Vis, Proc. Linn. Soc. N.S.Wales, viii., 1883, p. 284.
- Girella multilineata*, Clarke, Trans. N.Zeal. Inst., xxxi., 1899, p. 98 pl. vii. *Id.*, Waite, Rec. Cantb. Mus., i. 1, 1907, p. 21.

D. xv/12; A. iii/12; P. 17; V. i/5; C. 17. L. lat. 46; 49 rows of scales between the scapula and the hypural joint and about 46 directly above the lateral line; 8 scales between the lateral line and the back below the middle of the dorsal fin excluding those of the scaly sheath.

Depth before the ventral fins 2·6 in the length from the snout to the hypural joint; head 3·6 in the same. Eye 5 in the head and 1·6 in the interorbital space; length of the snout and the width of the interorbital space equal, 3·09 in the head. Eighth dorsal spine 2·3, third dorsal ray 2·09, and third anal ray 1·6 in the head. Pectoral 1·2, and ventral 1·3 in the head.

Head largely naked, though the temporal region and upper half of the operculum are scaly, and small scales cover the cheek and postocular region. Profile slightly convex, the snout obtusely conical; interorbital space convex. Eye much narrower than the interorbital space, and but little broader than the preorbital bone. Nostrils close together, with raised skinny margins which may be subdivided into a few fimbriae. Maxillary hidden by the preorbital; jaws subequal. Preoperculum with a broad naked border, its edge entire. Operculum with a flat spine. A band of teeth arranged in oblique series of about three or four in front of each jaw, compressed, with simple trenchant edges (female); behind these there is a broad band of minute, more or less tricuspid teeth in each jaw.

Body covered with finely ctenoid scales of moderate size which extend forward to and end abruptly above the anterior portion of the eye. They form sheaths at the bases of the dorsal and anal fins, and extend up between the rays of the vertical fins. They are largest on the sides of the body and tail, and smallest on the nuchal region, breast and abdomen. Caudal peduncle as deep as long.

First dorsal commencing directly behind the vertical of the opercular lobe, its spinous portion almost twice as long as the soft. Margin of the spinous dorsal rounded, the spines increasing in length to about the eighth and then decreasing again backwards; third dorsal ray highest, longer than the longest spine, the others decreasing backwards. Anal opposite and longer than the soft dorsal; third spine longest and more than half as long as the third ray which is much longer than that of the dorsal. Pectoral obtusely pointed above, its margin rounded. Ventrals a little shorter than the pectorals, and inserted a little before the middle of their length; they reach five-sixths of their distance from the vent. Caudal emarginate, the lobes pointed.

*Colour*.—Almost uniform brown after preservation, the pectoral and ventral fins lighter; broad darker bars extend horizontally between each row of scales. In life, the colour is silver grey tinged with bronze, with the back smoky and the belly lighter. Eleven or twelve dark grey bands descend from the dark part of the back onto the silver of the sides, one being before the dorsal fin and one behind it; these are narrow, covering one or two rows of scales, and they descend almost to the ventral surface above the anal fin but not so low elsewhere. Fins smoky grey.



Described from a female example 290 mm. long from Port Macquarie, New South Wales. The accompanying figure is prepared from the same specimen, but the colour-marking is copied from another in which the dark bands chance to have been preserved.

*Variation.*—The dark bands referred to rarely show in preserved examples, and are variable in both number and intensity in fresh specimens. They are most apparent in light coloured examples, and appear to be intensified under stress of excitement as when the fish is hooked; if the fish be swimming quietly in a pool they are scarcely visible, and the whole body is darker than when it is first taken from the water. Incipient albinos have been forwarded to the Australian Museum which are almost uniformly canary yellow in colour, while a true albino which was captured near Sydney is white with the back and sides closely speckled with silver-grey dots. In eleven specimens from various localities, the dorsal spines and rays vary in number from xiv-xvi and 11-13 respectively; one abnormal specimen had five anal spines, of which the third and fourth arose from the same base though they were not united.

Notes on the occurrence and habits of this species have been published by Stead<sup>6</sup>.

*Synonymy.*—Klunzinger (1872), Castelnau (1872), and McCoy (1883), each suggested the specific identity of *Girella tricuspidata* and *G. simplex*. Stead (1908) recorded that the form commonly recognised as *G. simplex*, in which the outer teeth have truncate cutting-edges, is merely the female form of *G. tricuspidata* which has distinctly trilobate teeth; but he offered no proof of his statement. I am indebted to Mr. F. McNeill for an interesting series of jaws, milts, and rows, taken from fifty-five specimens which were secured by himself at or near Coogee, near Sydney, at various dates in April and May, 1919. The teeth of the outer series in both jaws are distinctly trilobate in all (fifteen) the males; two specimens, however, have a few truncate teeth near the symphyses of the jaws, some of which are functional while the others are small and partly embedded in the gum. In thirty-nine of the females, these teeth are almost all truncate; one or more of the lateral teeth are sometimes distinctly trilobed, and one example has a well developed trilobed tooth among the truncate ones at the symphysis. One pair of jaws associated with large ovaries has almost all the teeth trilobate, but a few median and lateral teeth are truncate. The teeth of the females have truncate edges in their earliest stages, as is proved by an examination of some extracted from the gum at the base of and anterior to the functional series; on the other hand, the teeth of the males are distinctly trilobed in their early stages. The minute teeth of the inner band in each jaw are more or less trilobed in both sexes, though more markedly so in males than in females.

Two specimens caught on a line in succession at Maroubra, 29th June, 1919, which offered no differences other than in dentition, proved to be

<sup>6</sup> Stead—Fish. Austr., 1906, p. 91, and Ed. Fish. N.S.Wales, 1908, p. 49.

male and female upon dissection; in the male the teeth were all tricuspid, while they were trenchant in the female, thus bearing out the observations recorded above.

*Girella blackii*, Castelnau, was included in the synonymy of *G. tricuspidata* by Ogilby in 1893, while the identity of *G. percoides*, Hector, and *G. simplex* was recognised by Hector in 1877. *Otenolabrus kuovi*, Hutton, was recognised as a synonym of *G. simplex* by Gill in 1893.

A specimen in the old collection of the Australian Museum is labelled as *Girella ramsayi*, though it unfortunately has no other data. It is apparently the holotype of Macleay's species, no other example so labelled being in either the Macleay Museum or the Australian Museum collections. It agrees with the brief description of *G. ramsayi* in its length and major details, though some proportions of the eye, snout and interorbital space are a little different. It agrees with the description in having only two perfect anal spines, but the malformed base of a third is quite distinct. It does not differ in any details from specimens of *G. tricuspidata* of the same size.

Mr. Ogilby has compared the holotype of *Girella mentalis*, De Vis, in the Queensland Museum with an example of *G. tricuspidata*, and finds no difference between them except that the holotype has only thirteen dorsal spines. He notes that though he has examined scores of specimens of *Girella* from Moreton Bay, he has not found another specimen to agree with De Vis' example in this detail, and therefore regards the latter merely as an unusual variation of *G. tricuspidata*.

The type of *G. carbonaria*, De Vis, is apparently lost. This imperfectly described species is here regarded as probably synonymous with the female form of *G. tricuspidata*.

Two male examples about 350 mm. long, recently secured at Kuwan Island, New Zealand, by Mr. C. Hedley, agree well with Clarke's description and figure of *Girella multiliacata*. A careful comparison of them with specimens of *G. tricuspidata* from Sydney, however, reveals no distinguishing characters to substantiate the New Zealand species.

*Distribution*.—*Girella tricuspidata* was originally described from Shark Bay, Western Australia. The species has since been recorded from Victoria, Tasmania, New South Wales, Moreton Bay, and New Zealand.

#### *GIRELLA ELEVATA*, Macleay.

Black Drummer; Rock Blackfish.

(Plate xiii., fig. 1.)

*Girella elevata*, Macleay, Proc. Linn. Soc. N.S.Wales, v., 1881, p. 408. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 18. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 26. *Id.*, Stead, Ed. Fish N.S.Wales, 1908, p. 51, pl. xx.

D. xiii/14; A. iii/11; P. 18; V. i/5; C. 15. 51 rows of scales below the lateral line between the scapula and the hypural joint and about the

same number directly above it; about 8 scales between the lateral line and the back below the middle of the dorsal fin, not including those of the scaly sheath.

Depth before the ventrals 2·4 in the length from the snout to the hypural joint; head 3·7 in the same. Eye 4 in the head, and 1·3 in the interorbital space; length of the snout and width of the interorbital space equal, 3 in the head. Last dorsal spine 2, third dorsal ray 1·5, and second anal ray 1·2 in the head. Pectoral 1·09, and ventral 1·2 in the head.

Head largely naked; there is a small patch of scales above the operculum and on the temporal region, and a narrow series extends downward behind the eye and expands over the cheek. The profile is convex and the snout tumid; interorbital space convex. Eye much narrower than the interorbital space, and but little broader than the preorbital bone. Nostrils large, close together, with fimbriate edges, the anterior with a dermal lobe. Maxilla extending back almost to below the anterior orbital border, and completely hidden by the preorbital when the mouth is closed; jaws subequal. Cheek-scales minute and irregular; preopercular edge smooth, with a broad naked border. Operculum with two flat spines, the lower somewhat pointed, the upper rounded. Outer teeth of each jaw arranged in a single row, with strongly tricuspid edges; there are about fourteen larger teeth in each jaw, and the upper row is continued backward on the sides to the end of the premaxilla by some minute teeth: the inner teeth of each jaw are minute, flattened, tricuspid, and arranged in a broad band.

Body covered with ctenoid scales of moderate size, which extend forward to, and end abruptly on the neck. They form sheaths at the bases of the dorsal and anal fins, and extend up between the bases of the spines and rays of all the fins except the ventrals. They are largest on the sides and caudal peduncle, and smallest on the nuchal region, breast and abdomen. Caudal peduncle as deep as long.

First dorsal commencing directly behind the vertical of the opercular lobe, its spinous portion about once and one-third as long as the soft. The margin of the spinous portion is rounded, and the spines increase rapidly in length to the fifth, after which they increase very slightly to the last; anterior dorsal rays distinctly higher than the spines, the third longest; margin of the soft dorsal rounded. Anal opposite, and as long as the soft dorsal; the third spine is longest and about half as long as the anterior rays which are higher than those of the dorsal; the margin is rounded, its posterior portion subvertical. Pectorals rounded, the fifth upper ray longest; ventrals shorter than the pectorals, inserted well behind them, and reaching about three-fourths of their distance from the vent. Caudal subtruncate.

*Colour*.—Uniform dark bluish-brown in life, each scale with the middle of a lighter bluish colour and a well defined bronze border; the ventral surface is a little lighter in colour, with bronze reflections. The fins are uniformly slaty-brown. In alcohol the fish becomes of an almost uniform brown colour.

Described and figured from a young example 216 mm. long, secured at Maroubra near Sydney, by Mr. F. McNeill.

*Variation*.—In its younger stages this fish is more or less mottled with dark bifurcating bands descending from the back to the sides.

*Habits*.—According to Mr. McNeill, this fish frequents the foaming wash of the waves in the vicinity of weed-covered rocks on the coast near Sydney, where it procures the weed known as Sea-cabbage upon which it feeds. In calmer weather, it will allow itself to be carried over the rocks by the waves, and after taking a mouthful of the weed, hurries back with the receding water, though it is occasionally left stranded until another wave enables it to regain the water. When hooked, this fish endeavours to dart into a retreat among the rocks where it secures a hold among the shelves and ledges with its outstretched fins, and from which position it can only be dislodged with difficulty. It is commonly known as the Black Drummer. Further notes on the habits are given by Stead.

*Locs*.—*G. elevata* is known only from the vicinity of Sydney. Several specimens are in the Australian Museum from Maroubra, near Sydney, and one from Terrigal, a little farther to the north.

#### Genus GIRELLOPS, Regan.

*Girellops*, Regan, Proc. Zool. Soc., 1913, p. 369 (*Girella nebulosa*, Kendall and Radcliffe).

This genus has been separated from *Girella* and *Tephrocops* on account of the absence of an inner series of teeth in each jaw. In the following species a few minute and almost rudimentary inner teeth are present, which, however, are very different to those of *Girella* and *Tephrocops* in which they are numerous, flattened, and arranged in a broad band.

#### GIRELLOPS FIMBRIATUS, *sp. nov.*

(Plate xiii., fig. 2.)

D. xvi, 12; A. iii, 10; V. i, 5; P. 16; C. 17. 71 rows of scales below the lateral line between its origin and the hypural joint, and about 86 rows above it; 12-13 scales in a row between the lateral line and the back below the eighth dorsal spine excluding those on the base of the fin.

Depth before the ventrals 2.4 in the length from the snout to the hypural joint; head 3.6 in the same. Eye 4 in the head, 1.3 in the interorbital space, which is slightly less than the length of the snout; snout 2.7 in the head. Last dorsal spine 1.8, second dorsal ray 1.7, second anal ray 1.1 in the head. Pectoral subequal to the ventral, 1.05 in the head.

Head largely naked; there are small patches of scales above the operculum and on the temporal region, and a narrow series extends down behind the eye and expands over the cheeks. The profile is somewhat convex over the eye, but the interorbital space is nearly flat; the eye is much narrower than the interorbital space, which is a trifle shorter than the snout. Preorbital smooth, the space between the eye and the maxilla is more than one-half the width of the eye. Nostrils large and close together; the margins of both are closely fimbriate and the anterior has a posterior fimbriate lobe. Maxilla extending backward to below the anterior orbital border, expanded posteriorly; mandible shorter than the

upper jaw. Cheek-scales minute and irregular; preopercular edge entire, the angle rounded; a broad naked preopercular border. Operculum with two flat spines. The outer teeth of each jaw are arranged in a single row, and they have truncate edges, though one or two lateral ones are bi- or tricuspid; there are about twelve in each jaw, and they terminate abruptly at the sides, there being no minute lateral teeth as in *Girella*. The teeth of the inner series of each jaw are minute, spaced, and pointed, and are mostly arranged in a single row, though several scattered ones occur behind the others.

Body covered with small scales which extend forward to, and end abruptly on the neck; they cover the bases of the vertical fins, and extend up between the rays of all but the ventrals. The scales are strongly ctenoid on the body, but cycloid on the fins; they are smallest on the nuchal region, breast and abdomen, and largest on the sides and caudal peduncle. Caudal peduncle a little longer than deep.

First dorsal commencing a little behind the vertical of the opercular lobe, its spinous portion more than twice as long as the soft. The margin of the spinous dorsal is rounded, and the spines increase rapidly in length to the fifth, after which they increase slightly to the last, which is a little shorter than the anterior rays. Soft dorsal highest anteriorly, the margin rounded. Anal commencing beneath the posterior dorsal spines and terminating before the soft dorsal; the length of its base is subequal to that of the soft dorsal; the second and third spines are subequal in length, and about one-half as long as the anterior rays; second ray longest, the posterior margin of the fin subvertical. Pectorals and ventrals subequal in length, the latter reaching to the first anal spine. Caudal a little emarginate.

*Colour*.—Uniform dark brownish-grey after preservation in formaline, the pectoral and dorsal fins somewhat lighter than the others.

Described from a single specimen 159 mm. long, which was collected at the Kermadec Islands by Mr. W. R. Oliver in 1908, and was forwarded to the Australian Museum by Mr. Edgar R. Waite.

This species differs from the figures of *G. nebulosus*, Kendall and Radcliffe, principally in having markedly fimbriate nostrils, but this character is unfortunately not referred to in the description of that species. The development of a few teeth in an inner series in each jaw also distinguishes it from *G. nebulosus*, in which they are wanting.

*Loc.*—Kermadec Islands.

### FAMILY LABRIDÆ.

#### Genus *CORIS*, *Lacepède*.

#### *CORIS REX*, *Ramsay and Ogilby*.

(Plate xiv., fig. 2.)

*Coris rex*, Ramsay & Ogilby, Proc. Linn. Soc. N.S.Wales, x. 4, 1886, p. 851.

*Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 46. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 39. *Id.*, Stead, Ed. Fish. N.S.Wales, 1908, p. 84.

D. ix/12; A. iii/12; V. i/5; P. 13; C. 14. L. lat. 98; about 9 scales between the bases of the anterior dorsal spines and the lateral line, and about 35 more to the ventral surface.

Depth before the ventrals 3.28 in the length to the hypural joint; head, from the lips to the end of the opercular lobe, 3.45 in the same. Eye-opening 8.3 in the head, and 2.2 in the interocular width; snout, including the lips, 3 in the head. Posterior dorsal spine 2.7, average dorsal and anal rays 2.2 in the head.

Body compressed, the dorsal and ventral profiles almost evenly convex. Caudal peduncle deep and compressed, its length equal to about two-thirds of its depth. Head naked, rhomboidal, the snout sharply conical and the operculum produced into a broad lobe. Eye small, interocular space convex. Mouth a little oblique, the upper jaw slightly longer than the lower, the maxilla reaching backward to below the posterior nostril. Teeth conical, in two rows in each jaw, the inner ones much smaller and less numerous than the outer; the anterior pair of premaxillary teeth project forward as strong canines, and are followed by a pair of curved smaller ones, behind which the succeeding teeth decrease in size backwards; anterior mandibular canines closing within the upper ones, the following teeth similar to but larger than those of the premaxillaries; a pair of canines at each posterior angle of the mouth. Opercular bones with thin membranous margins, the preopercular angle rounded.

The scales commence on an oblique line extending back from the nape above the eye to the upper angle of the gill-opening, and leave a median area on the neck before the dorsal fin almost naked. They are cycloid and subequal in size, and extend over the basal third of the caudal fin. Lateral line curved upward toward the back anteriorly and then extending in a straight line backward and slightly downward to below the ninth and tenth dorsal rays, where it drops sharply to the median line of the caudal peduncle; its tubules are simple, and cease on about the third scale behind the hypural joint.

Dorsal fin commencing above the middle of the operculum, its margin uninterrupted and somewhat rounded. The anterior spines increase a little in height backward, but the remainder are subequal in length; the rays are higher than the spines and of subequal length. Anal similar to and opposite the soft dorsal. Ventral inserted below the anterior pectoral base, the first ray elongate and reaching to the vent. Caudal apparently subtruncate.

*Colour-marking.*—Very faded after long preservation in alcohol. Head nearly uniform, but darker above, while the opercular lobe is dark bluish-black towards its edges. Anterior half of the body light yellowish with two dark purplish-brown cross bands; the posterior half is brown, and the junction of the two is sharply defined. A broad dark purplish-brown area on the back between the first and sixth spines extends across the sides towards the ventral region as a well defined band, and becomes rapidly narrower as it descends beneath the pectorals; it is lost below in a rather ill-defined darker area on the breast and pectoral region. The second cross band is still darker and better defined; it descends from the bases of the last two dorsal spines and the first ray towards the vent and

spinous portion of the anal. Spinous dorsal uniformly dark except around the base of the seventh spine; soft dorsal light basally but darker along the middle of its length and with a narrow marginal stripe. Anal almost uniformly faded but with a narrow marginal stripe like the dorsal. Pectoral with an ill-defined oblique band at about the middle of its length and a broad dark terminal and marginal band. Ventrals and caudal uniform, the membrane of the latter apparently darker than the rays.

Described and figured from the holotype, 404 mm. long, which is in a rather poor state of preservation. It does not show the details of the dorsal and anal fin markings very well, so these have been supplemented in the figure from those of a second specimen of similar size and characters from New Zealand.

The original description of this species was based upon a fresh specimen, and the details of the colour-marking as given by Ramsay and Ogilby are so different to what is now observed in the same example that it is difficult to understand how such extraordinary changes have taken place. It must be noted also, that the length of the specimen was stated to be 16.50 inches, whereas it is now slightly less than 16 inches. Its authenticity however, is beyond doubt, since its registration number and accompanying data tally exactly with those given by Ramsay and Ogilby, and no other specimen in the Australian Museum collection can be associated with their description.

But few specimens of this species appear to have found their way to museum collections, only one other having reached the Australian Museum since the holotype was acquired. This is 460 mm. in length, and is generally darker in colour with less contrast between the lighter and darker markings, though this may be the result of its imperfect preservation. Stead records a third large example from Sydney, while a fourth about 390 mm. long (tail imperfect), has been sent to me from New Zealand for identification by Mr. Louis T. Griffin, which is very similar in all details to the holotype.

*Locs.*—Bondi, Sydney, holotype. Cuvier Island, near the entrance to Hauraki Gulf, North Island, New Zealand.

### Family ODACIDÆ.

Genus *OLISTHOPS*, Richardson.

*OLISTHOPS CYANOMELAS*, Richardson.

(Plate xiv., fig. 3.)

*Olisthops cyanomelas*, Richardson, Proc. Zool. Soc., xviii., November 1850, p. 75, Pisc. pl. iii., figs. 1-2, and Ann. Mag. Nat. Hist. (2), vii., 1851, p. 291. *Id.*, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 155. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 40, and Rec. Austr. Mus., vi., 1905, p. 71. *Id.*, Stead, Fish. Austr., 1906, p. 147, and Ed. Fish. N.S.Wales, 1908, p. 85, pl. lvi. *Id.*, Ogilby, Proc. Roy. Soc. Qld., xxi., 1908, p. 25.

- Olisthrops cyanomelas*, Günther, Brit. Mus. Cat. Fish., iv., 1862, p. 243.  
*Id.*, Castlenau, Proc. Linn. Soc. N.S.Wales, iii., 1879, p. 354. *Id.*,  
 Macleay, Proc. Linn. Soc. N.S.Wales, vi., 1882, p. 110. *Id.*, Ogilby,  
 Cat. Fish. N.S.Wales, 1886, p. 47. *Id.*, Lucas, Proc. Roy. Soc. Vict.  
 (2), ii., 1890, p. 33. *Id.*, Ogilby, Ed. Fish. N.S.Wales, 1893, p. 145.  
*Olisthrops brunneus*, Macleay, Proc. Linn. Soc. N.S.Wales, iii., 1878, p. 36,  
 pl. v., fig. 1, and vi., 1882, p. 110.  
*Olisthrops brownii*, Johnston, Proc. Roy. Soc. Tasm., 1883 (1884), p. 193,  
 and 1890 (1891), p. 35. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales,  
 ix., 1884, p. 443.

D. xviii/9; A. iii/9; P. 11; V. 5; C. 12. L. lat. 52; l. tr. 7/15.  
 Depth before the ventrals about 4·7 in the length to the hypural joint;  
 head including the opercular lobe, 3·9 in the same. Eye 1·6 in the snout,  
 and 5·8 in the head. Interorbital space equal to the length of the snout,  
 and 3·5 in the head. Caudal peduncle almost half as deep as long. Second  
 dorsal spine 2·5, penultimate dorsal ray 2, and pectoral 1·6 in the head.

Body rather elongate, compressed, almost evenly arched above and  
 below. Head almost naked, only a few small scales forming a patch above  
 the operculum. Lines of pores extend around the eye, on the snout,  
 around the preopercular margin, and across the nape. Eye of moderate  
 size, rounded; interorbital space slightly convex. Nostrils separated by  
 a short space, minute, the anterior in a short tube, the posterior a simple  
 opening near the eye. Upper jaw overhanging the lower; mouth hori-  
 zontal, the opening extending a little farther back than the vertical of the  
 anterior nostril. Teeth coalesced into two laminae in each jaw, which have  
 crenulate edges and are peaked at their symphyses. Preopercular margin  
 largely hidden in the membrane, only the rounded discal margin being  
 free. Operculum produced into an angular lobe, unarmed.

Body covered with cycloid scales which commence abruptly on the nape,  
 and increase in size as they extend backward to the tail. They cover  
 the extreme bases of the dorsal and anal rays, and enlarged scales extend  
 over the basal third of the caudal fin, but the pectoral base is naked.  
 Lateral line formed of simple tubes, a little arched anteriorly, and then  
 extending downward till it reaches the middle line of the body.

Second dorsal spine highest, the others decreasing in height till the  
 sixteenth, which is much shorter than the eye; the seventeenth and  
 eighteenth are longer, and are scarcely distinguishable from the rays.  
 The rays increase in length to the eighth or ninth, and the last is divided  
 to its base. Anal similar in form to the soft dorsal, but both its origin  
 and termination are behind those of that fin. Pectoral inserted in advance  
 of the dorsal origin, its second ray longest. Ventral inserted below the  
 anterior half of the pectoral and reaching almost half its distance from  
 the vent; the spine is slender, and there are only four rays, of which the  
 first is longest. Caudal margin lunate, the outer rays prolonged.

*Colour*.—Head and body olive brown above, changing to rich orange  
 on the sides and light salmon-colour on the belly, when in a fresh  
 condition. Head with anastomosing dark blue lines and spots, which  
 become pale green and less numerous on the upper surface. Each scale



of the body with a large dark blue spot, which is often elongate and coalescent with its neighbours. Spinous dorsal transparent orange-brown, with a few pale green spots on the spines; soft dorsal, anal, and caudal orange like the body, with dark blue lines and spots between the rays. Pectoral olive-brown, with blue lines and spots. Ventral orange and pink, mottled with olive. Eye light green and pale gold.

Described and figured from a specimen 29.4 mm. long from the snout to the end of the middle caudal rays.

*Variation*.—An extraordinary range of variation in the colour and marking has been recorded by both Castelnau and Stead. The male, which has been figured by Richardson, is usually dark bluish-black with a rich blue streak on each lobe of the caudal and sometimes on the pectoral also; the female is lighter in colour, and ornamented in the manner described above. But this colour marking is not constant, and Stead (1906) records a male example having all the colouration of the female.

The posterior dorsal spines resemble the rays so closely that it is difficult to determine their number, while the first two anal spines are so hidden in the membrane as to be easily overlooked. The following table illustrates some variation in these and other details.

Locality	Dorsal spines & rays	Shortest spine	Anal spines & rays	Lateral line
N.S. Wales ...	26	15	iii/8	52-53
Port Jackson	27	15	iii/10	53-55
Tasmania ...	27	16	iii/9	55-56
Abrolhos Ids.	27	15	iii/9	58-56

*Synonymy*.—According to Richardson's original description, the type of *O. cyanomelas* had only 48 scales in a longitudinal series instead of the usual 52-58. This statement, combined with the difficulty of counting the dorsal and anal spines and rays, and also the extraordinarily variable colouration, has led to the establishment of two other specific names, *O. brunneus*, Macleay, and *O. brownii*, Johnston, both of which are apparently synonyms of *O. cyanomelas*. Castelnau regarded *O. brunneus* as a mere colour variation of *O. cyanomelas*, and though this synonymy was doubted by Macleay, it has been accepted by all later authors; the type is brown in colour without markings, but it does not differ in any structural details from the specimen here described and figured. The validity of *O. brownii*, was even doubted by its author, and I find no reason to separate it from Richardson's species.

*Localities*.—Several specimens are in the Australian Museum from near Sydney, one from Tasmania, and one from the Abrolhos Islands, Western Australia. The species has been recorded from Southport, Queensland, by Ogilby so that its range extends from Southern Queensland to Tasmania and south-western Australia.

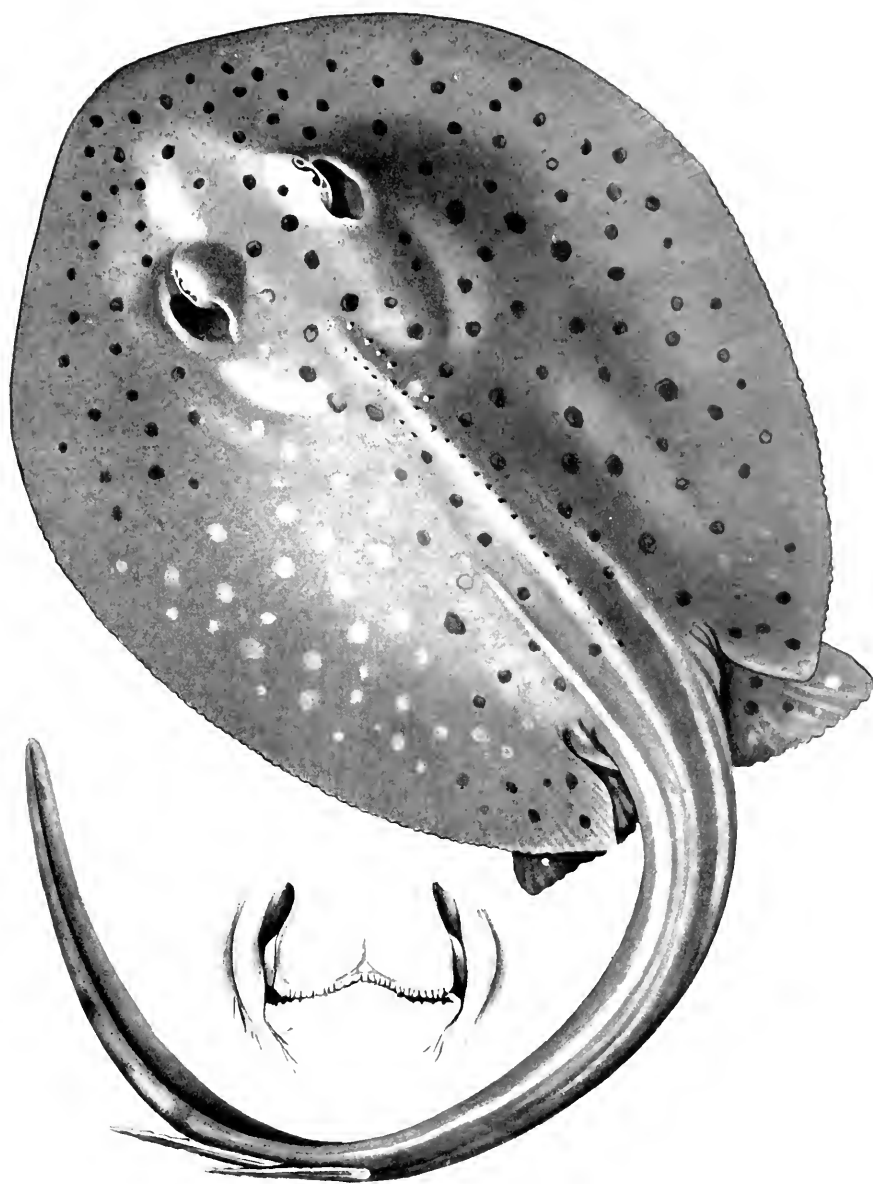




EXPLANATION OF PLATE X.

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*Taeniura lymna*, Forskal. A female, 229 mm. wide, from Murray Island,  
Torres Strait.





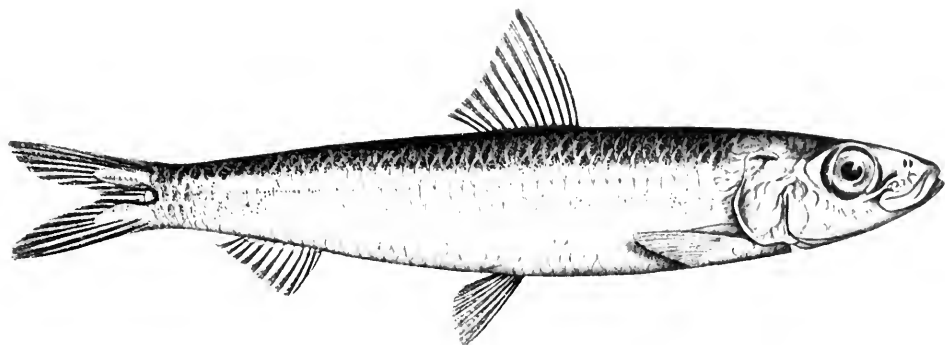


EXPLANATION OF PLATE XL.

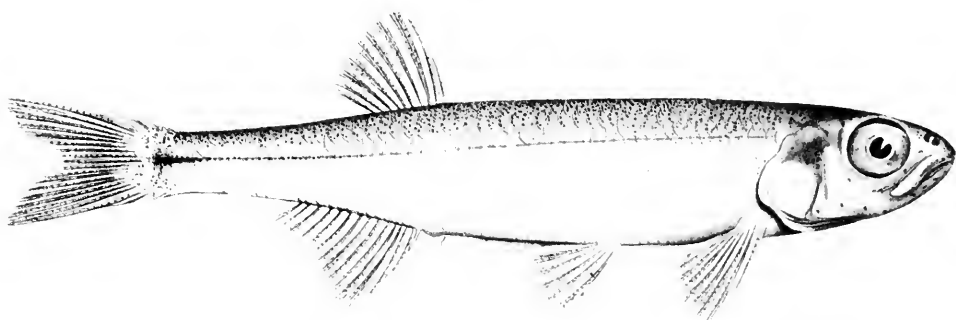
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- Fig. 1. *Stolephorus robustus*, Ogilby. Lectotype, 63 mm. long, from Maroubra Bay, near Sydney.
- .. 2. *Retropinna semoni*, Weber. A specimen 41 mm. long, from Ithaca Creek, Brisbane.
- .. 3. *Retropinna semoni*, Weber. A specimen 55 mm. long, from Sackville, Hawkesbury River, New South Wales.
- .. 4. *Retropinna tasmanica*, sp. nov. Holotype, 67 mm. long, from the Huon River, Tasmania.

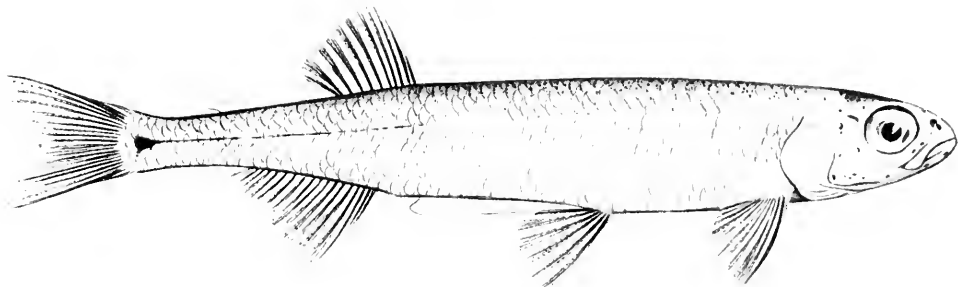




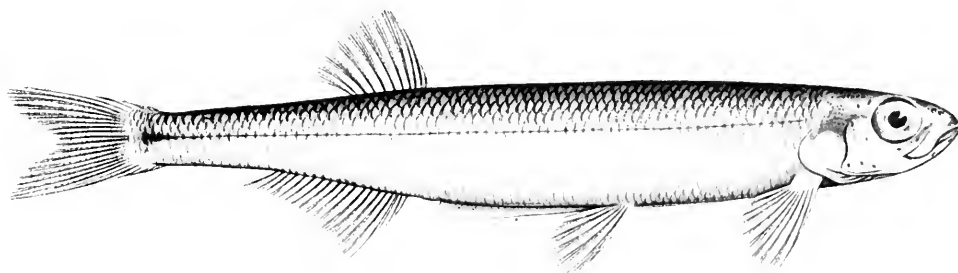
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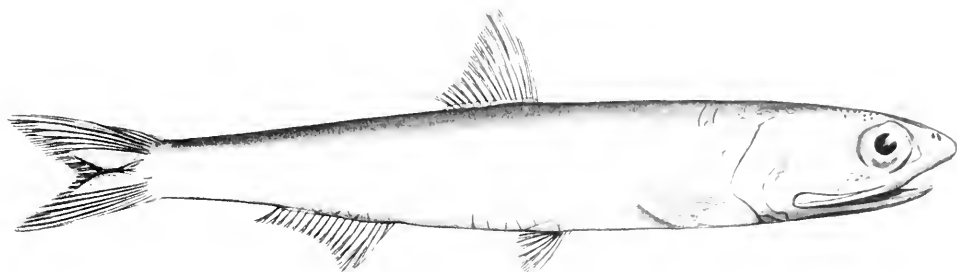




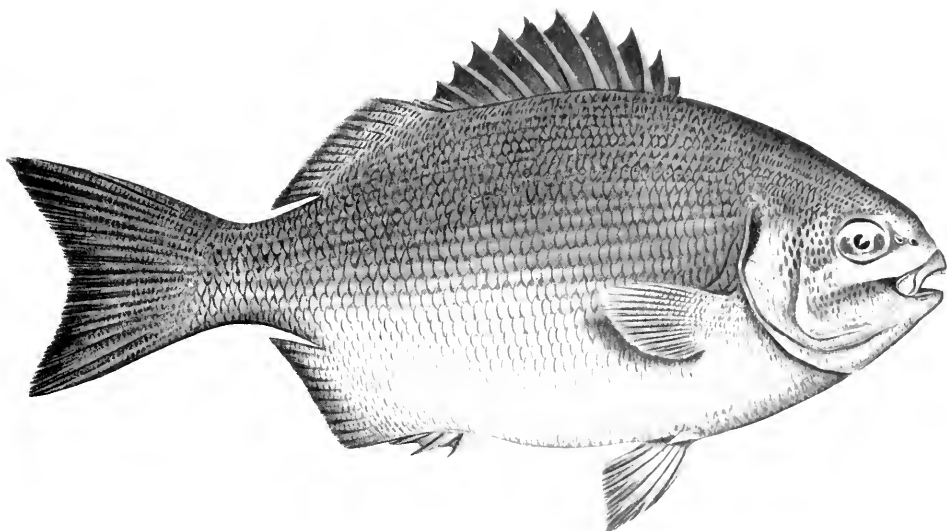
EXPLANATION OF PLATE XII.

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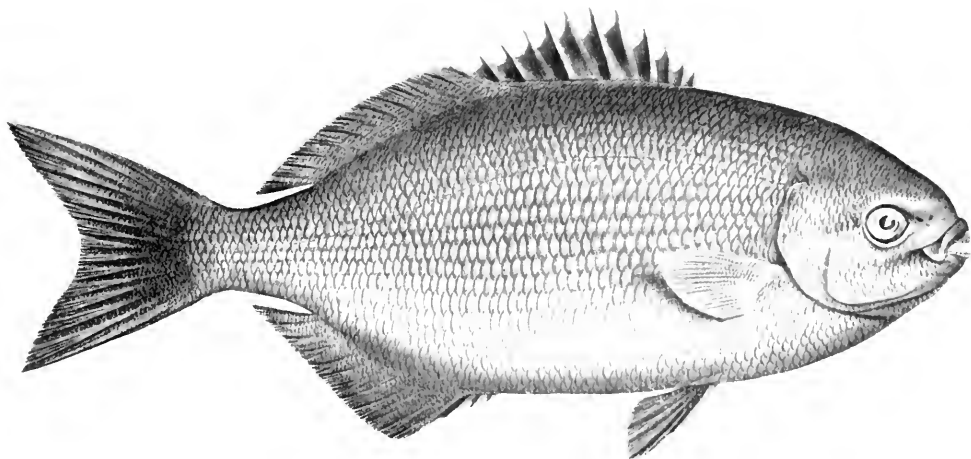
- Fig. 1. *Eupracalis australis*, Shaw. A specimen 107 mm. long, from Port Hacking, New South Wales.
- .. 2. *Kyphosus snyderianus*, Günther. A young specimen 245 mm. long, from near Sydney.
- .. 3. *Kyphosus gibsoni*, Ogilby. Holotype, 387 mm. long, from Moreton Bay, Queensland.



1



2



3



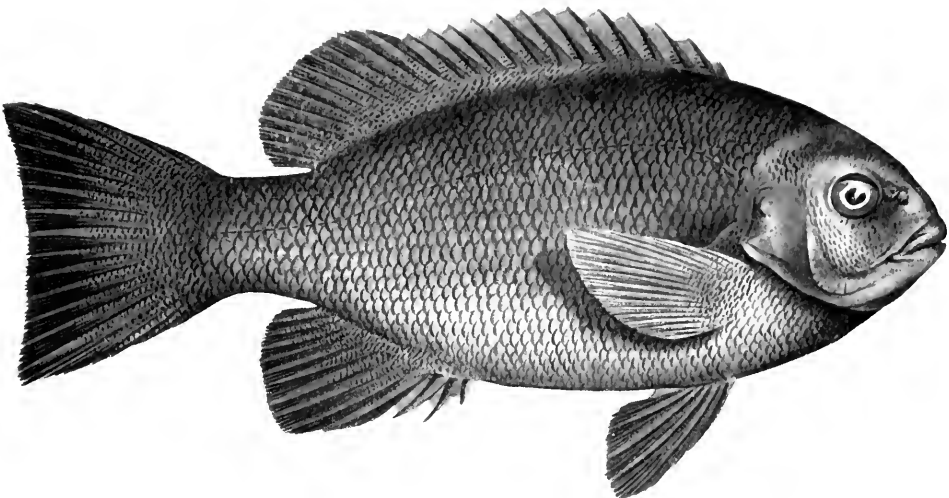


EXPLANATION OF PLATE XIII.

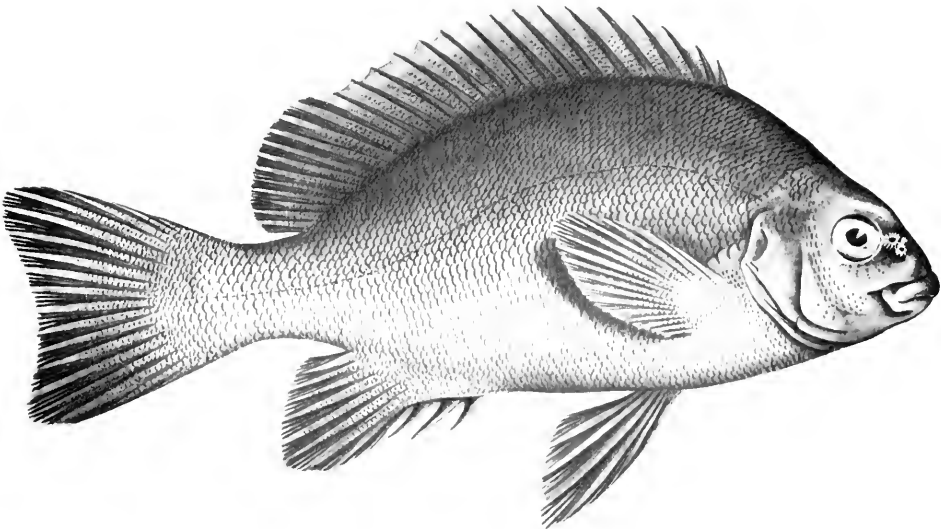
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- Fig. 1. *Girella clerata*, Macleay. A young specimen, 216 mm. long, from Maroubra, near Sydney.
- .. 2. *Girellops fimbriatus*, sp. nov. Holotype, 159 mm. long, from the Kermadec Islands.





1



2

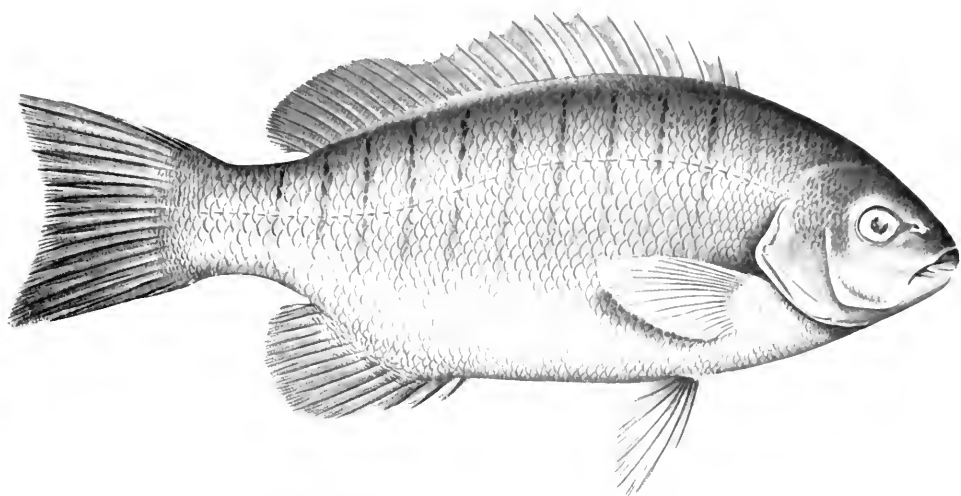




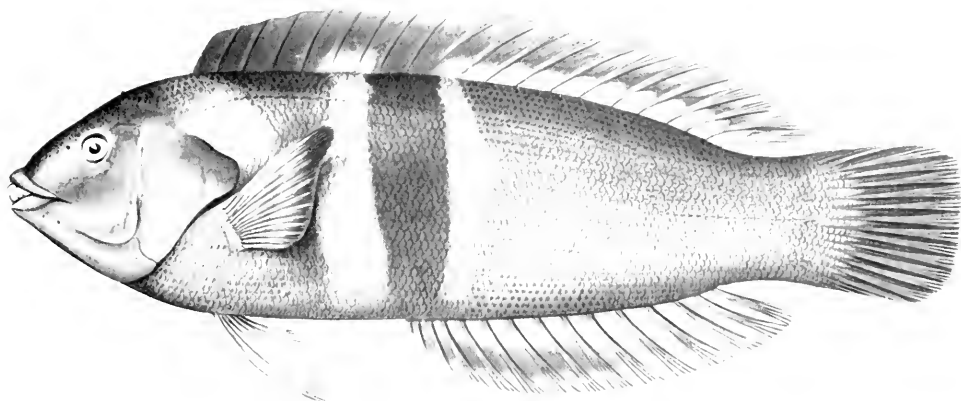
EXPLANATION OF PLATE XIV.

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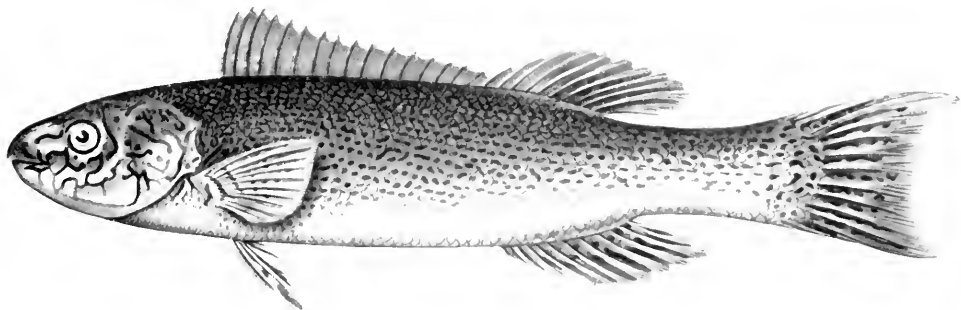
- Fig. 1. *Girella tricuspidata*, Quoy and Gaimard. A female specimen 290 mm. long, from Port Macquarie, New South Wales. The colour-marking is copied from another specimen.
- „ 2. *Coris xer*, Ramsay and Ogilby. Holotype, 404 mm. long, from Bondi, near Sydney.
- „ 3. *Oligthops cyathometus*, Richardson. A specimen 294 mm. long, from near Sydney.



1



2



3



## RECORDS OF THE AUSTRALIAN MUSEUM.

VOL. XIII., No. 2.

A new species of *Bonellia* from Port Jackson

By Prof. T. Harvey Johnston, M.A., D.Sc., and O. W. Tiegs, B.Sc.

Page 74, Line 7, should read  $\frac{3}{4}$  inch, not 3.4.

„ 74	„ 33	„	„	1.1 mm.	„ 11.
„ 75	„ 1	„	„	$\frac{1}{2}$ inch	„ 1.2.
„ 75	„ 3	„	„	$\frac{1}{3}$ „	„ 1.3.
„ 75	„ 27	„	„	$\frac{1}{2}$ „	„ 1.2.

THE earliest record of *Bonellia* in the South Pacific is that by Professor Haswell who, in 1885, reported what he believed to be *B. viridis* from Neutral Bay, Port Jackson; noting at the same time that instead of inhabiting narrow fissures in rocks it was found under small stones just above the limit of low water. Anatomically his specimens were said to be identical with *B. viridis*, except with regard to the reproductive organs which, however, were immature.

Whitelegge<sup>1</sup> reported *B. viridis* from another locality in Port Jackson, viz., Mosman Bay, obtaining his specimen under a stone during a low tide.

Shipley<sup>2</sup> recorded the species from the Loyalty Islands, and from the D'Entrecasteaux Group.

In considering the remarkable known distribution of this species, viz., Mediterranean, North Sea and South Pacific, Sluiter<sup>3</sup> expressed the opinion that a detailed examination of specimens from the last named locality would show them to be distinct from the European form. In the case of the Sydney material we have found this view to be justified. The specimens are not *B. viridis*, but closely resemble *B. minor*. Full descriptions of the latter are not at our disposal, but even from the meagre accounts that we have, it is clear that the two species are not identical. If they had proved to be so, then, taking into account the known distribution of *B. minor* (viz., the Mediterranean) the occurrence would have been just as remarkable as if they had proved to be *B. viridis*. It should be stated, however, that Ikeda<sup>4</sup> has reported *B. minor* from Japan, noting at the same time certain differences in the anal vesicles, which again differ from those of the Australian forms here described.

We desire to express our indebtedness to the Director of the Australian Museum, Sydney, for allowing us to re-examine Mr. Whitelegge's specimen; and to Professors W. A. Haswell, F.R.S., and S. J. Johnston of the Sydney University for the opportunity to use Professor Haswell's original material.

<sup>1</sup> Whitelegge—Proc. Roy. Soc. N.S.Wales, xxiii., 1889, pp. 163-323.

<sup>2</sup> Shipley in Willey's Zoolog. Results, iii., 1899, pp. 335-353.

<sup>3</sup> Sluiter—Siboga Expeditie, Monogr. 25 (Gephyrea), 1902.

<sup>4</sup> Ikeda—Journ. Coll. Sci. Univ. Tokyo, xx., 1904, pp. 72-73.





# A NEW SPECIES OF *BONELLIA* FROM PORT JACKSON.

BY

PROFESSOR T. HARVEY JOHNSTON, M.A., D.Sc., F.L.S.,

and

O. W. TIEGS, B.Sc., Biology Department, Queensland University.

(Plates xv.-xvi.)

The earliest record of *Bonellia* in the South Pacific is that by Professor Haswell who, in 1885, reported what he believed to be *B. viridis* from Neutral Bay, Port Jackson; noting at the same time that instead of inhabiting narrow fissures in rocks it was found under small stones just above the limit of low water. Anatomically his specimens were said to be identical with *B. viridis*, except with regard to the reproductive organs which, however, were immature.

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<sup>1</sup> Whitelegge—Proc. Roy. Soc. N.S.Wales, xxiii., 1889, pp. 163-323.

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<sup>4</sup> Ikeda—Journ. Coll. Sci. Univ. Tokyo, xx., 1904, pp. 72-73.

*BONELLIA HASWELLI* n. sp.

The following description is based on an examination of the preserved specimens, one collected by Whitelegge<sup>5</sup> and the other by Professor Haswell<sup>6</sup>. They were preserved in alcohol, and were, of course, decolourised. The colour of the living worms was stated to be green.

The animal has a typical *Bonellia* shape (Pl. xv., fig. 1), the sac-like body measuring over two inches in length and 3·4 inches in greatest breadth: while the contracted proboscis measures about four inches, and each arm of the bifurcation about 1½ inches. The ventral proboscis-groove is very distinct.

The skin is marked by transverse ridges consisting of rows of rather small papillae, just visible to the naked eye. This marking occurs uniformly over the whole body, but not on the proboscis.

In section (Pl. xvi., Fig. 5), the wall is seen to consist of an outer epidermis, below which is a dermis, succeeded by three muscle layers. The epidermis consists of a layer of elongated, irregularly compressed cells, with darkly staining nuclei, among which lie a few scattered, heavily staining cells, probably of the nature of mucin-secreting gland cells. These do not extend into the dermis, as has been described in other forms (e.g., *Pseudobonellia*; *B. punicea*). The dermis is strongly developed, especially below the papillae, the whole of the internal mass of the latter being composed of it, no part of the muscle layers entering into its formation. The dermis may be divided into two very distinct parts, an outer somewhat hyaline, and an inner fibrous portion. The outer layer consists of a mass of loose connective tissue which is well developed at the sides of the papillae and also between them, though it may here be displaced by the fibrous layer. The dorsal part and the "core" of the papilla, however, consist of the fibrous layer. The fibres have a longitudinal direction: above, they form a dense layer beneath the papillary epidermis, and communicate below with the inner muscle layer, serving possibly as retractors of the papilla and thereby assisting in locomotion. The longitudinal muscle layer is not broken up into distinct bands.

There are two setae, measuring at least 11 mm. in length.

The alimentary canal is typical of *Bonellia*, but is somewhat more strongly coiled. The pharynx is wide, the œsophagus narrow and thick-walled, while the intestine is wide and very thin walled, narrowing off towards the anus. Numerous strong mesenteric strands pass from the body wall to the intestine. In this species a definite siphon is present. It originates as a very narrow tube on the dorsal surface of the pharynx and widens somewhat posteriorly. It has no posterior communication with the intestine, but ends blindly in a curious lobulated structure. Possibly this is the degenerated remains of a complex funnel similar to

<sup>5</sup> Whitelegge—*Ibid.*

<sup>6</sup> Haswell—Proc. Linn. Soc., N. S. Wales, x., 1885, pp. 331-2.

that described by us for *Pseudobonellia*<sup>7</sup>. The siphon is nearly 1·2 inches in length, and is surrounded by peritoneum which connects it posteriorly with the intestine. The posterior end of the siphon is about 1·3 inches from the point where the mesentery attaches it to the gut-wall (Pl. xv., fig. 2; Pl. xvi., fig. 6).

Into the cloaca open the two anal vesicles. They are less elongate than in *B. viridis*. Into each open about fifteen tubes, some quite short, others much longer (Pl. xv., fig. 4; Pl. xvi., fig. 7). These tubes give off smaller or larger numbers, at times very large numbers, of secondary nephridial tubes, each ending in a narrow neck which bears a circular disc with the nephrostomial opening in its centre. The disc is composed of a ring of compressed elongated cells, with strongly staining nuclei, and fringed with a ring of cilia (Pl. xvi., fig. 8). Mesenteric strands pass from the body wall to the anal vesicles and to the larger tubes.

The vascular system is fairly typical. There is a narrow ventral blood vessel bifurcating below the pharynx. It is joined by a very large intestinal vessel which (Pl. xv., fig. 2) is seen as a definite structure adjacent to the intestinal walls, especially posteriorly.

The ovary resembles that of *B. viridis*. In one specimen it was only slightly developed; in the other it was much larger, lying midventrally along almost the whole of the length of the animal. The ova are large and round, with a prominent nucleus and a darkly staining nucleolus; the protoplasm is strongly vacuolated. The largest ovarian eggs measured 0·04 mm. in diameter.

There is a single uterus situated on the left side of the body. When empty it is a rather transparent organ, about 1·2 inches long. Situated at about one quarter of its length from the free end is the "uterine funnel." This is a peculiar little organ, less than 1 mm. long, consisting of a short hollow stalk, which widens out asymmetrically into a broad leaf-shaped opening, with a strongly crenated rim fringed with cilia. The internal opening is on a level with the walls of the uterus, i.e., there is no valvular mechanism such as occurs in *Pseudobonellia*. The end of the empty uterus is contracted into a blunt point showing strong longitudinal ridges, and probably admits of a fair amount of distension during sexual activity.

Males were sought for in the coelome, pharynx and uterus, but were not detected. It should be noted, however, that neither specimen was sexually mature.

We have pleasure in associating with this species the name of Professor W. A. Haswell, who has done so much to advance our knowledge of Eastern Australian Zoology.

The type specimen of *B. haswelli* collected by Whitelegge, is in the collection of the Australian Museum, Sydney, reg. no. G. 11,220.

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<sup>7</sup> Johnson and Tiegs—Proc. Linn. Soc. N.S.Wales, xlv., 1919, pp. 213-230.

Mr. C. Hedley many years ago collected a large specimen of a *Boiellia* at Masthead Island<sup>8</sup> and handed it to Professor Haswell who showed it to the senior author. It appeared to possess external characters and size similar to those of *B. haswelli*. Unfortunately the worm has been mislaid. It is quite likely that the Sydney specimens represent stray members of this species carried down the coast from the Queensland Barrier Reef by the warm southerly current which is usually deflected long before it reaches Sydney, but which sometimes reaches that latitude, bringing with it various invaders in the form of tropical and subtropical animals and plants, most of which fail to obtain a permanent foothold<sup>9</sup>. Probably the Sydney specimens travelled as trochophores. Their scarcity would account for the apparent absence of males in both cases, especially as it is stated that larvae require to come into contact with the female in order to develop into males, otherwise they become females.

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<sup>8</sup> Hedley—Proc. Linn. Soc., N.S.Wales, xxxi., 1906, p. 462.

<sup>9</sup> Hedley—Proc. Roy. Soc. N.S.Wales, xlix., 1915, p. 27.

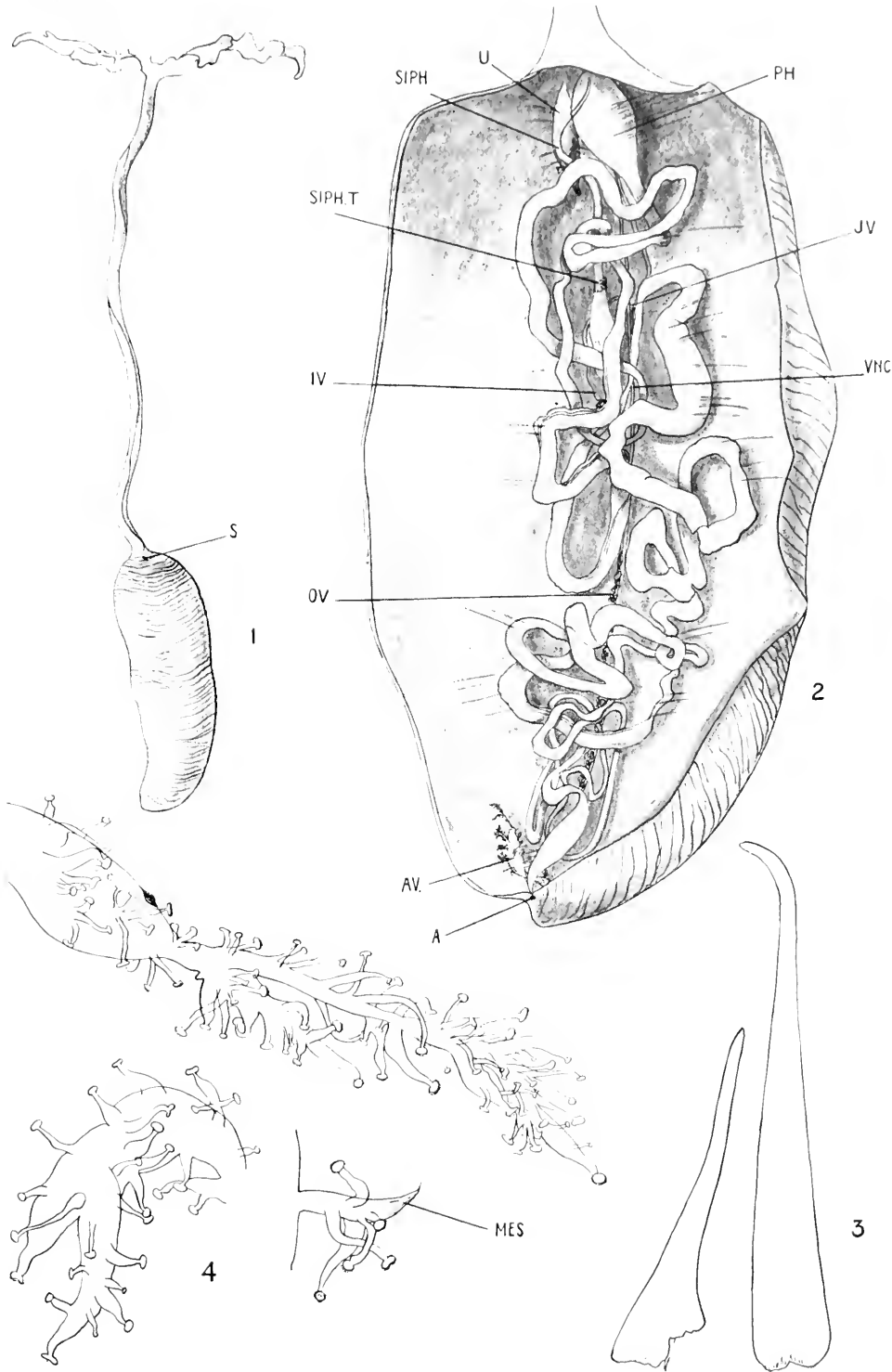


EXPLANATION OF PLATE XV.

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*Bouellia haswelli.*

- Fig. 1. Entire animal.  
„ 2. Dissection to show viscera.  
„ 3. Seta (one immature).  
„ 4. Groups of anal tubes.









EXPLANATION OF PLATE XVI.

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*Bonellia haswelli*.

Fig. 5. Longitudinal section of body wall.

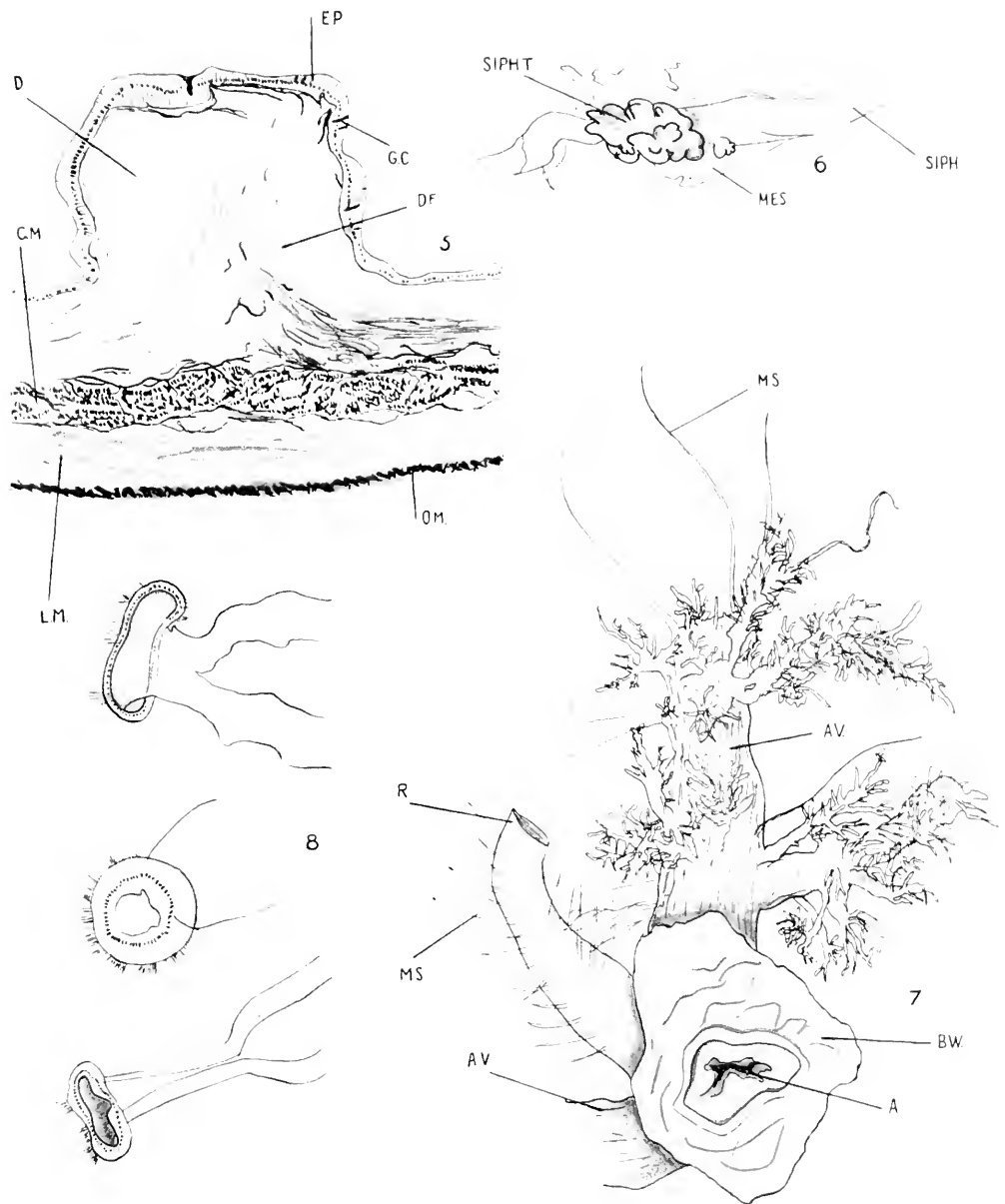
„ 6. Termination of siphon.

„ 7. Anal vesicle and adjacent structures.

„ 8. Three nephrostomes.

References to lettering:—

*a.*, anus; *a.v.*, anal vesicle; *b.w.*, body wall; *c.m.*, circular muscle; *d.*, dermis; *d.f.*, dermal fibres; *ep.*, epidermis; *g.c.*, gland cell; *i.v.*, intestinal bloodvessel; *j.v.*, junction of intestinal and ventral vessels; *l.m.*, longitudinal muscle; *mes.*, mesentery; *ms.*, mesenteric strands; *o.m.*, oblique muscle; *ov.*, ovary; *ph.*, pharynx; *r.*, rectum; *s.*, seta; *siph.*, siphon; *siph. t.*, folded termination of siphon; *u.*, uterus; *v.n.c.*, ventral nerve cord.





## TRAP-DOOR SPIDERS OF THE "CHEVERT" EXPEDITION.

BY

[the late] W. J. RAINBOW, F.E.S., Entomologist, Australian Museum.

(Figs. 1-8.)

In 1875 the late Sir William John (then Mr.) Macleay fitted out and conducted a scientific expedition for "a few months' cruise among the Islands of New Guinea and Torres Straits," for which purpose he chartered the barque "Chevert." As a result of this expedition, which occupied about six months, a large amount of material was collected, and a number of papers dealing with it were published in the two first volumes of "The Proceedings of the Linnean Society of New South Wales." Of the material thus collected, the Araneidæ were entrusted to the late Mr. H. H. Burton Bradley, and the greater part of it was worked out by him, the results being recorded in three short papers<sup>1</sup>. The total number of species enumerated was forty-three, of which fourteen were described as new. Since the demise of the author referred to, Mrs. Bradley, his widow, has presented to the Trustees of the Museum a collection of Australian and Papuan Araneidæ. The last-named series is especially interesting, since it proves to be of the Family Aviculariæ, and is labelled: "Papua: Chevert Expedition." No Terretelariæ were included by Mr. Bradley in his papers, owing, doubtless, to the poverty of literature upon the subject at that time, and to which, small though it was, access was naturally difficult if not impossible.

The majority of the species worked by Mr. Bradley were of the Family Argiopidæ; in addition to these there were a few Theridiidæ, one of the Pholcidæ, one of the Zodariidæ, and a couple of the Clubionidæ.

The Terretelarians, of which the present paper deals, includes some interesting forms. The genera represented are *Missulena*, Walck., one species; *Arbanitis*, L. Koch, two species; *Ischnocolus*, Auss., one species; *Idiactis*, L. Koch, one species; *Hadronyche*, L. Koch, one species; and *Ancpsida*, Rainb. and Pull., one species. Also, included in this collection there are a couple of mature specimens, and three half-grown examples of *Heurathela*, Auss. If there be no mistake about the locality label, then the occurrence of this genus in Papua is particularly interesting, since only two species of the genus have been recorded up to the present, and both of these are from New Zealand<sup>2</sup>. For further comments in respect of the genus under discussion see conclusion of this paper.

The student will note that in the descriptions given below, the falcæ are not included in measurements.

<sup>1</sup> Bradley—The Araneides of the "Chevert" Expedition, Part 1 (*Proc. Linn. Soc., N.S.W.*, i., 1877, p. 137); On Some New Forms of Arachnidæ (*op. cit.*, p. 220, pl. ii.); and The Araneides of the "Chevert" Expedition, Part 2 (*op. cit.*, ii., 1878, p. 115).

<sup>2</sup> Hogg—*Proc. Zool. Soc., Lond.*, 1901, p. 276.

## Family AVICULARIDÆ.

## Sub-family ACTINOPIDINÆ.

Genus *Missulena*, Walck.*MISSULENA OCCATORIA*, Walck.

*Missulena occatoria*, Walck., Tab. des Aran., 1805, p. 8, pl. ii., figs. 11-14.  
*Id.*, Ins. des Apt., 1837, p. 252<sup>3</sup>.

*Obs.*—This species has been recorded from many parts of Australia, particularly the Eastern, Southern and Western areas. More recently, however, I have seen examples from the far North, so that considering the former land connection of Australia with Papua, the above record is not remarkable for so common and widely distributed a species.

*Hab.*—Papua.

## Sub-family CENIZINÆ.

Genus *Arbanitis*, L. Koch.*ARBANITIS VILLOSA*, *sp. nov.*

(Figs. 1-3.)

♂. Cephalothorax, 9.5 mm. long, 7.5 mm. broad; abdomen, 7.5 mm. long, 5 mm. broad.

*Cephalothorax*.—Obovate, mahogany brown, clothed with golden-yellow hairs. *Pars cephalica* arched, moderately high, segmental groove broad, deep, sides not compressed; *ocular area* broader than long, raised, arched, fringed in front; *clipeus* yellow, narrow, truncated. *Pars thoracica* broad, arched, radial grooves broad, moderately deep; *thoracic fovea* deep, straight; *marginal band* broad, fringed with long hairs. *Eyes*.—Distributed over two rows of four each; front row strongly procurved; rear row procurved in front, recurved behind; anterior laterals elliptical, poised on black rings, and separated from each other by a space equal to that of three times their own individual diameter; rear medians round, as large as their anterior lateral neighbours, separated from each other by a space equal to that of one-half their own individual diameter, and each again from its lateral neighbour by rather more than that space; rear lateral eyes rather smaller than the anteriors, from which they are separated by about once their own individual diameter, elliptical, poised obliquely, and mounted on black rings; rear medians small, elliptical, each just touching the ring of its outer neighbour; they are also very close to the anterior medians, each being removed therefrom by a space scarcely equal to that of its own diameter (Fig. 1).



Fig. 1.

<sup>3</sup> For fuller synonymy of species recorded in this paper, see my Census of Australian Araneidae *Rec. Aust. Mus.*, ix., 2, 1911, pp. 108-112.

*Legs.*—Long, concolorous with cephalothorax, densely clothed with long golden-yellow hairs but displaying naked areas: each tibia and metatarsus bespined; metatarsi and tarsi i. and ii. scopulated; tarsi iii. and iv. also scopulated; tibia i. furnished with an apophysis; relative lengths: 1-4, 2, 3.

*Palpi.*—Moderately long, concolorous with legs, and similar to them in clothing; tibia inflated, and furnished with an apophysis; tarsal joint small, and armed with strong spines; bulb shining, bilobed, pyriform, slightly twisted, style grooved, short (Fig. 2).

*Falces.*—Moderately strong, concolorous with cephalothorax, clothed with long, coarse golden-yellow hairs but displaying naked areas: inner angle of the furrow of each falx armed with a row of six strong teeth, and the outer with several small ones; beard red, fang long, well curved, shining, reddish-brown.

*Maxilla.*—Arched, reddish-brown, hairy, furnished with a few small scattered spines; heel well rounded, inner angle of the apex of each falx terminating in an obtuse point; beard red.

*Labium.*—Concolorous, free, submerged, broader than long, arched, hairy, a few spines near apex. *Sternum.*—Concolorous also, hairy, somewhat pyriform, arched, longer than broad, and terminating obtusely between fourth coxæ; *sigilla* small, marginal.

*Abdomen.*—Obovate, slightly overhanging base of cephalothorax, arched, chocolate-brown, densely clothed with long yellowish hairs. *Spinnerets.*—Brown, hairy; superior pair stout, first joint longest, and the third shortest and dome-shaped; inferior spinners short, cylindrical, close together, and touching each other.



Fig. 2.

♀ Cephalothorax, 11.6 mm. long, 8.6 mm. broad: abdomen, 12.2 mm. long, 11.2 mm. broad.

*Cephalothorax.*—Obovate, chocolate-brown, uneven, clothed with long golden-yellow hairs. *Pars cephalica* ascending, arched, somewhat compressed, sides declivous, thoracic groove distinct; *ocular area* black, broader than long, raised, arched, fringed in front with a few stiff bristles; *clypeus* transversely wrinkled, deep, sloping forward, hyaline, tinged with reddish-brown, indented at middle. *Pars thoracica* broad, retreating, gently arched, radial grooves and depressions profound; *thoracic fovea* deep, slightly recurved; *marginal band* broad, yellowish, hairy. *Eyes.*—Distributed over two rows of four each: front row strongly procurved, rear row procurved in front and recurved behind; front lateral eyes

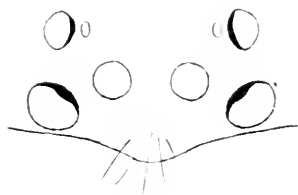


Fig. 3.

largest of the group, somewhat elliptical, poised obliquely, mounted on black rings, and separated from each other by a space equal to that of three times their own individual diameter; anterior medians round, and separated from each other by a space equal to fully once their own individual diameter, and each again from its anterior lateral neighbour by less than that space; posterior

lateral eyes nearly round and equal to anterior medians in size; lateral intermediates minute, elliptical, and each slightly removed from its lateral neighbour (Fig. 3). *Legs*.—Concolorous with cephalothorax, clothed with long golden-brown hairs and black bristles, but displaying naked areas: each leg armed on inner side with strong spines; meta-tarsi and tarsi i. and ii. scopulated; relative lengths: 4, 1, 2, 3. *Palpi*.—Strong, similar in colour, clothing and armature to legs i. and ii.; tarsi scopulated. *Falces*.—Chocolate-brown, projected well forward, clothed with coarse hairs and bristles, but displaying naked areas: *rustellum* consists of several transverse rows of strong teeth; inner angle of the furrow of each falx armed with a row of eight strong teeth, and the outer with nine small ones; *fang* long, dark brown, nearly black. *Maxilla*.—Reddish-brown, moderately arched, densely clothed with long hairs; heel well rounded; no spines present. *Labium*.—Concolorous, longer than broad, arched; submerged; no spines. *Sternum*.—Yellowish, pyriform, terminating obtusely between fourth coxæ, densely clothed with long hairs; *sigilla* marginal. *Abdomen*.—Obovate, chocolate-brown, arched, densely hairy. *Spinnerets*.—Stout, yellow, hairy; first joint of superior pair longest, the third shortest, and dome-shaped; inferior pair very short and close together.

*Obs.*—One male and several females. In alcohol the abdomen of some of the latter show faint indications of a colour pattern in the shape of thin broken transverse lines of yellow.

*Hab.*—Papua.

ARRANITIS BRADLEYI, *sp. nov.*

(Figs. 4-6).

♂ Cephalothorax, 8 mm. long, 6 mm. broad; abdomen, 8 mm. long, 6.3 mm. broad.

*Cephalothorax*.—Obovate, yellow-brown, uneven, clothed with yellowish hairs. *Pars cephalica* gently ascending, arched, moderately high, sides compressed, segmental groove distinct; *ocular area* broader than long, dark brown, raised, fringed in front with a few stiff bristles; *clypeus* broad, yellowish, truncate, transversely wrinkled. *Pars thoracica* broad, arched, radial grooves broad, deep; *thoracic furca* deep, straight; *marginal band* broad, undulated, fringed with long hairs. *Eyes*.—Distributed over two rows of four each; front row procurved, the rear straight in front and recurved behind; anterior laterals elliptical, poised obliquely, mounted on black rings, and separated from each other by a space equal to twice their own individual diameter; anterior medians round, separated from each other by a space equal to one-half their own individual diameter, and each again from its lateral neighbour by the same space; posterior laterals smaller than the front medians, elliptical, poised somewhat obliquely, and separated from the front laterals by a space equal to rather more than once their own individual diameter; rear medians small,



FIG. 1.



almost round, each just touching its lateral neighbour (Fig. 4). *Legs*.—Long, concolorous with cephalothorax, hairy but displaying naked areas; tibia i. furnished with an apophysis; metatarsi and tarsi i. and ii. scopulated; tarsi iii. and iv. also scopulated; relative lengths: 4.1, 2.3.



Fig. 5.

*Palpi*.—Moderately long, concolorous with cephalothorax, hairy; tibia inflated and furnished with a spined apophysis; tarsi small, bespined; bulb shining, bilobed, style slightly twisted, grooved, and moderately long (Fig. 5). *Palpes*.—Concolorous with cephalothorax, projected well forward, moderately strong, hairy, but displaying naked areas; inner angle of the furrow of each palpus armed with a row of six strong teeth, and the outer with a row of nine very small teeth, of which latter the three nearest the fang are the largest and widest apart; *rastellum* consists of two transverse rows of teeth; fang long, well curved. *Macillae*.—Reddish-yellow, arched, hairy, apex of inner angle terminating in an obtuse point; heel well rounded; no spines present. *Labium*.—Concolorous, short, broad,

arched, free, hairy, submerged; no spines present. *Sternum*.—Concolorous also, pyriform, moderately arched, hairy, and terminating obtusely between fourth coxae; *sigilla* small, marginal. *Abdomen*.—Ovate, arched, slightly overhanging base of cephalothorax, hairy; superior surface chocolate-brown, ornamented in front with three large yellow spots, which latter are close together and nearly confluent; below these there is a series of transverse, slightly curved, broken yellow markings, of which the front pair are the largest; inferior surface yellow (Fig. 6). *Spinnerets*.—Yellow, hairy; first joint of superior pair longest, and the third shortest and dome-shaped; inferior spinnerets cylindrical, and once their own individual transverse diameter apart.



Fig. 6.

*Obs.*—Two mature males and one half-grown female. Judging by the latter the sexes are much alike both in colour and abdominal ornamentation. The sternum appears to be relatively broader than in the male, and the inferior spinnerets are quite close together instead of being once their own individual transverse diameter apart.

*Hab.*—Papua.

*Sub-family* AVICULARINÆ.

*Genus* Ischnocolus, *Auss.*

ISCHNOCOLUS LUCUBRANS, L. Koch.

*Ischnocolus lucubrans*, L. Koch, Die Arach. des Austr., i. 1874, p. 487, pl. xxxvii., figs. 4, 4a; Hogg, Proc. Zool. Soc., Lond., 1901, p. 244.

*Obs.*—One specimen of what appears to be the above, and which agrees very well with L. Koch's description and figure, is included among the "Chevert" material, but it is, as suggested by Hogg (*supra*), in all probability a young example of some other genus. The specimen under discussion has its tarsal scopulae divided by a fine line of setae, but Mr. R. J. Pocock has pointed out<sup>1</sup> that among those species which in the adult state have an integral scopula, the latter is always more or less divided in the earlier stages. As there is only one example in this collection, and that one damaged, I prefer to follow the example of my friend, Mr. H. R. Hogg, and to let the matter remain as it stands for the present. Koch's type came from Port Mackay, North Queensland.

*Hab.*—Papua.

*Sub-family* BARYCHELINÆ.

*Genus* *Idioctis*, L. Koch.

*IDIOCTIS PAPUENSIS*, *sp. nov.*

(Fig. 7.)

♀ Cephalothorax, 4.6 mm. long, 3.2 mm. broad; abdomen, 5.6 mm. long, 3.2 mm. broad.

*Cephalothorax*.—Obovate, elongate, yellow. *Pars cephalica* ascending, arched, high, sides compressed, segmental groove distinct; *ocular area* broader than long; *clypeus* narrow. *Pars thoracica* arched, uneven, radial grooves rather deep; *thoracic fovea* straight; *marginal band* fringed with rather long hairs. *Eyes*.—Distributed over two rows of four each; front row touching edge of clypeus, well procurved; rear row recurved behind; front laterals largest of the group, elliptical, poised obliquely, and three times their own individual diameter apart; anterior intermediates round, separated from each other by a space equal to that of one-half their own individual diameter, and each again from its lateral neighbour by a similar space; rear laterals rather smaller than the anterior intermediates, elliptical, obliquely poised, and each separated from its anterior lateral neighbour by a space equal to one-and-a-half its own diameter; rear intermediates minute, each just touching the outer ring of its lateral neighbour (Fig. 7). *Legs*.—Concolorous with cephalothorax, moderately long, rather strong, hairy but displaying naked areas, each armed with rather long though not strong spines; tarsi i. and ii. scopulated; relative lengths: 4, 1, 2, 3. *Palpi*.—Long, strong, similar in colour, clothing and armature to legs; tarsi scopulated. *Falces*.—Concolorous with cephalothorax, projecting, arched, hairy, but displaying naked areas; inner ridge of the furrow of each falx armed with a row of six teeth; a light *castellum* present.



Fig. 7.

<sup>1</sup> Pocock. Ann. Mag. Nat. Hist., (6), xvi., 1895, pp. 225-230.

*Maxilla*.—Pale yellow, rather short, broad, arched, hairy, apex of inner angle obtusely pointed; no spines present. *Labium*.—Concolorous, short, broader than long, arched, almost triangular, widest at base, moderately hairy, apex fringed with dark bristles; no spines present. *Sternum*.—Concolorous, longer than broad, arched, almost parallel-sided, moderately clothed with coarse hairs; *sigilla* small, marginal. *Abdomen*.—Obovate, hairy, arched, just overhanging base of cephalothorax; superior surface yellow-brown, ornamented with five short, narrow, curved, transverse yellow bars, the first three of which are broken at the middle; sides and inferior surface pale yellow. *Spinnerets*.—Yellow, hairy, short; superior pair stout, tapering, first joint longer than the second and third combined, terminal joint shortest; inferior pair very short, cylindrical, and separated from each other by a space equal to that of once their own individual diameter.

*Hab.*—Papua.

*Sub-family* DIPLURINÆ.

*Genus* Hadronyche, L. Koch.

HADRONYCHE HIRSUta, *sp. nov.*

(Fig. 8.)

♀ Cephalothorax, 12 mm. long, 11.2 mm. broad; abdomen, 12.2 mm. long, 9.9 mm. broad.

*Cephalothorax*.—Obovate, mahogany-brown, moderately hairy. *Pars cephalica* ascending, high (though not so much so as in *Missalema*, Walek.), shining, well arched, smooth, segmental groove deep; *ocular area* broader than long, not raised; *clypeus* narrow, truncated. *Pars thoracica* uneven, arched, radial grooves deep; *thoracic fovea* deep, procurved; *marginal band* broad, yellow. *Eyes*.—Distributed over two rows of four each; anterior row straight in front, slightly recurved behind; rear row also straight in front but recurved behind; anterior lateral eyes largest of the series, elliptical, and poised on black rings; front medians round, separated from each other by a space equal to once their own individual diameter, and each again from its lateral neighbour by about half that space; rear laterals elliptical, each separated from its anterior lateral neighbour by a space equal to that of one-half the diameter of one of the front median eyes; rear intermediates round, each just touching the ring of its outer neighbour; rear row slightly longer than the anterior (Fig. 8). *Legs*.—Strong, not long, concolorous with cephalothorax, densely hairy, but displaying naked areas; each metatarsus armed with a double row of spines; there are also three or four strong spines on tibiae i. and ii.; scopula and spines on all four tarsi; relative lengths: 1, 4, 2, 3. *Palpi*.—Short, stout, concolorous with legs, densely hairy, tibiae and tarsi armed with numerous



Fig. 8.

spines. *Falces*.—Powerful, projecting, thickly clothed with long hairs, but displaying naked areas; inner angle of the furrow of each falx armed with fifteen strong teeth, and the outer with ten; between these two rows there is a dense cluster of very small teeth; fang well curved, long, almost black. *Maxille*.—Moderately long, reddish-brown, well arched, clothed with long hairs, apex of inner angle terminating in an obtuse point, inner area densely spined. *Labium*.—Concolorous, free, longer than broad, well arched, moderately clothed with long hairs, apex densely spined. *Sternum*.—Concolorous also, somewhat pyriform, deeply excavated in front, arched, thickly clothed with long hairs; *sigilla* marginal, anterior and median pairs small, posterior pair rather large. *Abdomen*.—Obovate, dark-brown, arched, slightly overhanging base of cephalothorax, densely hairy. *Spinacrets*.—Yellow, short, stout, hairy; superior pair tapering, first joint longest, second shortest, the third coniform; inferior pair close together, cylindrical, apices truncated.

*Obs.*—The species described above is very distinct from that of *H. cerbera*, L. Koch. In the female of the species quoted, the anterior row of eyes is recurved, instead of being straight, and the front medians are the largest of the series; in the male this row is straight, but the relative sizes are the same. The abdomen is round, as broad as long and only sparingly hairy, whilst in *H. hirsuta* (*supra*) it is obovate and densely clothed with hairs. These points serve easily to differentiate the two species, but the student is directed to Koch's description and figures<sup>5</sup>.

*Hab.*—Papua.

*Genus Anepsiada, Rainb. & Pull.*

ANEPSIADA VENTRICOSA, Rainb. & Pull.

*Anepsiada ventricosa*, Rainb. and Pull., Rec. Aust. Mus., xii., 7, 1918, p. 167, pl. xxiv., fig. 120.

*Obs.*—This, the type species of the genus, was originally recorded from Cloucurry, Central Queensland. Though varying very slightly in size the two Papuan examples of the "Chevert" Expedition present no distinct differences from the Cloucurry example.

*Hab.*—Papua.

*Genus Hexathele, Anss.*

HEXATHELE HOCHSTETTERI, Anss.

*Hexathele hochstetteri*, Anss., Verh. zool.-bot. Ges. Wien, 1871, p. 171; L. Koch, Die Arach. des Austr., i., 1873, p. 459, pl. xxxv., fig. 7; Hogg, Proc. Zool. Soc., Lond., 1901, p. 276, fig. 41.

*Obs.*—If, as pointed out in my introductory remarks (p. 77, *note*) the specimens of the above species were correctly labelled, then the occurrence

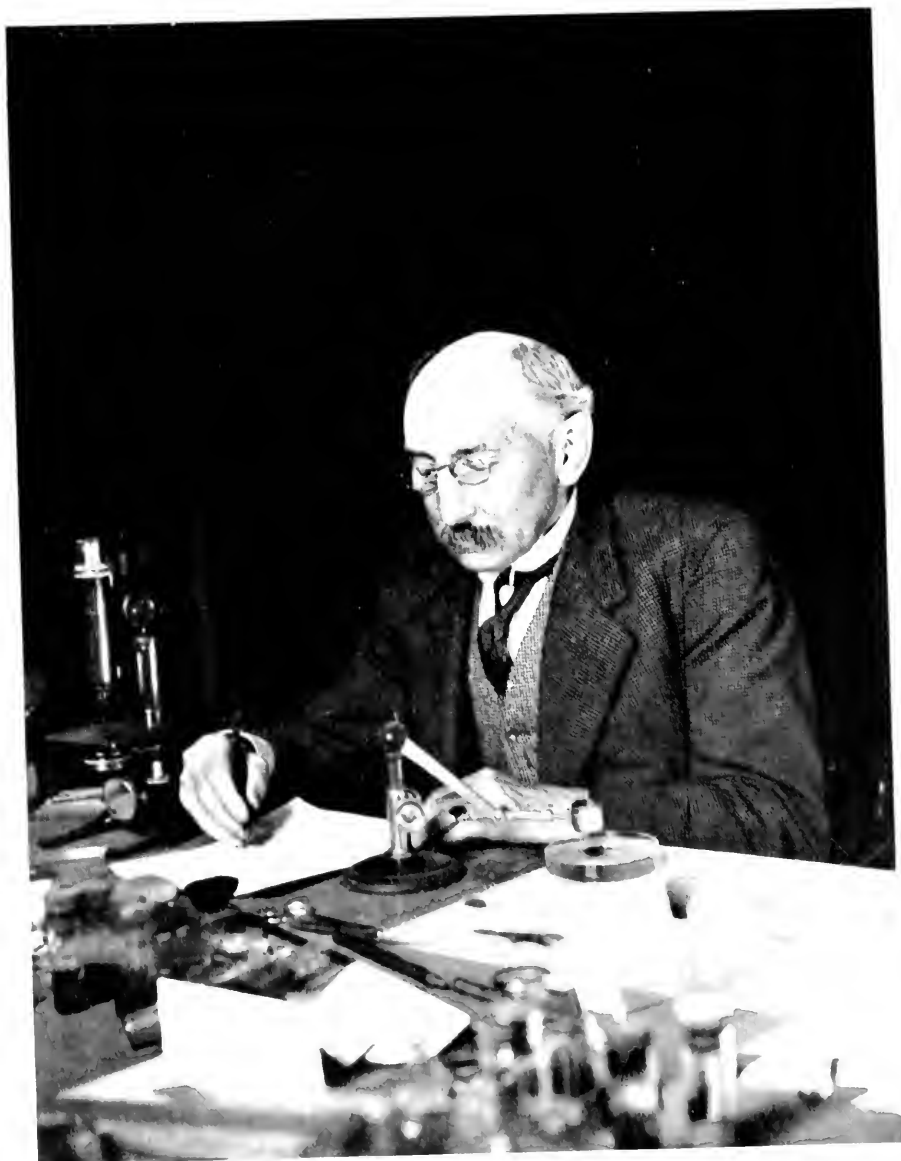
<sup>5</sup> L. Koch—Die Arach. des Austr., i., 1873, p. 463, pl. xxxv., figs. 6, 6a, 6b, 6c.

of this species in Papua is interesting. At any rate it is here tentatively recorded, for it is quite possible the specimens may have accidentally found their way into the bottle of Papuan material. The specimens, of which two are mature and three immature, bear out L. Koch's description and figure, the abdominal colour pattern being equally as distinct and strongly marked in each example under review as in the picture. On the other hand Hogg (*supra*) in his description of specimens examined by him says:—"Abdomen dark grey-brown above, dark but rather yellowish below, no pattern discernible." From this it would appear that the species is variable.

*Hab.*—? Papua.







WILLIAM JOSEPH RAINBOW

FROM A RECENT PORTRAIT



## OBITUARY.

WILLIAM JOSEPH RAINBOW.

Entomologist, 1895 to 1919.

After a long and painful illness Mr. William Joseph Rainbow, Entomologist, to the Australian Museum, passed away on the 21st November, 1919, at the age of 63.

Of Mr. Rainbow's early life and his entrance into the field of Entomology a few notes will doubtless prove of interest.

Mr. Rainbow was born in Yorkshire in 1856, and as his father was a Warrant Officer in the Royal Marines he spent much of his boyhood in the naval towns. It was in these towns and also in Edinburgh that he received most of his education. In 1873 he left England with his parents for New Zealand, and on the long sea voyage out young Rainbow acted as schoolmaster to the numerous children on the emigrant ship. On arrival in New Zealand he took up newspaper work, and was for some years on the literary staff of the "Wanganui Herald," edited and owned by Mr. John Ballance who in later years was destined to become the Premier of the Colony.

It was to Mr. Ballance that Mr. Rainbow was indebted for help and encouragement in furthering his studies in Natural History, a subject in which he appears to have shown an early interest. It is doubtless to this encouragement on the part of his chief that Mr. Rainbow's eminent position in science is due.

In 1883 Mr. Rainbow arrived in Sydney from New Zealand and during the year married Arriette Dainty of New Zealand. For some years he served on the staffs of the "Daily Telegraph," "Sydney Morning Herald," "Evening News" and other prominent local journals.

Mr. Rainbow subsequently abandoned journalistic work for a position in the Government Printing Office, from which service he withdrew in 1895 to fill the post of entomologist to the Australian Museum. During his career as entomologist to this institution, Mr. Rainbow contributed many papers to science embodying the results of his entomological and arachnological researches. His papers total 71 in number, and he also published two brochures "A Guide to the Study of Australian Butterflies" and "Mosquitoes: Their Habits and Distribution." The majority of his papers are devoted to the order Arachnida, a group which has always met with little favour in the eyes of naturalists. It is by his labours on this important branch of biological science that Mr. Rainbow's name will be remembered. He was long regarded as the leading authority in Australia on this group and his death robs science of one of her ablest workers. When we realise under what great physical disabilities Mr. Rainbow laboured, we cannot but highly commend the spirit with which he was endowed, for he was at all times of a genial and sunny nature and showed a devotion to duty even when racked with suffering.

Mr. Rainbow was for years a member of the Linnean Society of New South Wales and was also on the Council of the Royal Zoological Society of New South Wales. He was one of the original founders of the Naturalists' Society of New South Wales, and was on the Council up to the time of his death. He was also a Fellow of the Entomological Society of London, a Fellow of the Linnean Society of London, and a Membre de la Société Entomologique de France.

The last few years of Mr. Rainbow's life were beset with trials and anxieties. His second son, Sergeant Oscar A. Rainbow, who had enlisted early in the war was killed at the Dardanelles on May 25th, 1915. Mr. Rainbow's wife never recovered from the shock and it undoubtedly hastened her decease, which occurred on June 6th, 1917. His youngest son Sergeant Eric Rainbow enlisted in Carmichael's Second Thousand and during his absence abroad Mr. Rainbow's health completely failed. He ultimately succumbed to his malady on the 21st November, 1919, his son arriving from England a few days after his death.

Mr. Rainbow leaves two sons to mourn his loss, Mr. William A. Rainbow, Librarian to the Australian Museum, and Mr. Eric Rainbow.

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70. Insecta and Arachnida from North-West Australia. *Trans. Roy. Geo. Soc. Austr. (S.E. Branch)*, 1916-1917, pp. 284-288. (In collaboration with A. Musgrave).
71. Australian Trap-door Spiders. *Rec. Austr. Mus.*, xii., 7, 1918, pp. 81-169, pls. xii.-xxiv. (In collaboration with Dr. R. H. Palleine).

#### POSTHUMOUS.

72. Arachnida from Lord Howe and Norfolk Islands. *Rec. S. Austr. Mus.*, i., 3, 1920, pp. 229-272, pls. xxviii.-xxxi.
73. Trap-door Spiders of the "Chevert" Expedition. *Rec. Austr. Mus.*, xiii., 3, 1920, pp. 77-85, eight text-figures.

ANTHONY MUSGRAVE,

Entomologist,

Australian Museum.

In addition to these papers the late Mr. Rainbow left a completed manuscript entitled "Spiders from Molangul, S.E. Queensland" together with sketched figures. If suitable arrangements for the completion of these sketches can be made it is hoped to publish this paper. Editor, *Australian Museum Records*.



ON A NEW SPECIES OF CRAWLING MEDUSA  
(*CNIDONEMA HASWELLI*) FROM AUSTRALIA.

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(Plates xvii.-xviii.)

INTRODUCTION.

In a recently published paper Gilchrist<sup>1</sup> has described a new genus and species of crawling Medusa, *Cnidonema capense*,<sup>2</sup> from the Cape of Good Hope. From an examination of both the medusa and the hydroid stage of the Cape species he concludes that the crawling Medusæ of the Southern Hemisphere are generically distinct from the northern forms.

The crawling Medusæ of the Northern Hemisphere belong to the genus *Elentheria*, which is represented by only two species, *Elentheria dichotoma*, Quatrefages, and *E. claparedoi*, Hartlaub.

The first crawling Medusa to be recorded from the Southern Hemisphere was described by Browne<sup>3</sup> in 1902 as *Elentheria callentini*, from a single specimen obtained from Stanley Harbour, Falkland Islands.

Later, specimens of a pelagic animal were taken by the French Antarctic Expedition (1903-5) off Wandel Island, and in a short paper "Sur un Animal pélagique de la Région antarctique" Bedot<sup>4</sup> referred the specimens to a new genus and species, *Wandelia charcoti*.

In 1910 Browne<sup>5</sup> described another new species, *Elentheria hodgei*, which was obtained by the National Antarctic Expedition from McMurdo Sound. At the same time he recognised that the animal of unknown affinities described by Bedot as *Wandelia charcoti* was also a species of *Elentheria* and changed the name to *E. charcoti*.

In the following year (1911) Vanhöffen<sup>6</sup> described and figured the small crawling Medusa which Chun had previously referred to the genus *Elentheria* in his "Reiserbericht über die Tiefsee-Expedition." These specimens were collected by the German Deep Sea Expedition on the lobes of the thallus of *Macrocytis* in Gazelle Harbour and Observatory Bay, Kerguelen. As the result of his examination of this material from Kerguelen, Vanhöffen concludes that the three southern species,

<sup>1</sup> Gilchrist—Quart. Journ. Micro. Sci. (n.s.), lxiii., 4, 1919, pp. 509-529.

<sup>2</sup> Not *capense*; *Cnidonema* is neuter gender.

<sup>3</sup> Browne—Ann. Mag. Nat. Hist. (7), ix., 1902, p. 279.

<sup>4</sup> Bedot—Expéd. Antaret. Française (1903-5), Charcot, 1908, pp. 1-5.

<sup>5</sup> Browne—National Antarctic Expedition, (1901-1904), Nat. Hist., v., 1910, Coelenterata, v.—Medusæ, p. 28.

<sup>6</sup> Vanhöffen—Wissen. Ergebnisse der Deutschen Tiefsee-Exped., "Valdivia," xix., 5, 1911, pp. 193-233.

*E. callentini*, *E. charcoti*, and *E. hodgei* are specifically identical, and explains away the differences between these species and the Kerguelen form by assuming that they are due to mistaken observations by Browne and Bedot made on insufficient material. On this basis he reduces all the southern forms of crawling Medusa to a single species and, together with his own, refers them to *Eleutheria callentini*, Browne.

Finally in 1919 Gilchrist found a crawling Medusa in fair abundance in a tank of the Government Marine Laboratory, near Cape Town, and on search being made on the sea shore further specimens were obtained from sea-weed collected at low tide. Gilchrist, moreover, ultimately succeeded in tracing the Cape Medusa to the hydroid stage, which he observed in one of his tanks in which the crawling Medusa had appeared in two successive summers. The characters of both the medusa and the hydroid stage disclosed the necessity for separating generically the southern from the northern forms; Gilchrist, therefore, instituted the genus *Unidoumna*, with *U. capense* for its type, to accommodate the Cape species and probably the other southern species of crawling Medusæ.

The discovery of yet another species of crawling Medusa from the Southern Hemisphere is extremely interesting: a new species of *Unidoumna*, closely allied to *U. capense*, has now been found to occur in Port Jackson, Australia.

#### MATERIAL INVESTIGATED.

I am greatly indebted to Professor W. A. Haswell, Emeritus Professor of Zoology in the University of Sydney, for the opportunity of examining and describing this crawling Medusa from Port Jackson. The material placed at my disposal consisted of twenty-seven specimens which had been fixed in sublimate-acetic and preserved in 70% alcohol. Professor Haswell first observed the Medusa in March, 1917, while working over a collection of sea-weeds obtained from the sides of a rock-hewn bathing pool at Point Piper, a sandstone headland on the southern shore of Port Jackson, about two and three-quarter miles from the entrance to the harbour.

In company with Professor Haswell I visited this locality on 10th September, 1919, and succeeded in obtaining twelve specimens which served as a basis for making observations on the living animal. These were examined in small pots in which the sea water was changed each morning and evening. This method was employed until 19th September, when ten specimens were fixed in hot sublimate-acetic and the remainder transferred to a glass vessel containing 150 c.c. of sea water. On 28th September, the Medusæ were still alive though very sluggish in their movements, and the pigmentation showed signs of fading. The sea water had now evaporated to about one-half its original volume; in this concentrated solution the specimens were kept under further observation until 6th October, when they disintegrated after living twenty-six days without any food having been added to the water.

As a result of subsequent visits to the same locality during October and November, additional specimens were procured including some which were much younger than those previously found.



The Medusa was also studied by means of fixed material. Serial sections were cut in two directions, transversely and vertically, and were stained with Ehrlich's Hematoxylin followed by Eosin. The sections were cut in thicknesses varying from 8 to 10  $\mu$ .

#### METHOD OF COLLECTING.

The search for the crawling Medusa has been conducted at Point Piper, Port Jackson, from low water-mark down to three to five feet below it. The material was obtained by scraping down the face of a weed-covered wall and collecting the dislodged masses of sea-weed and other marine growths in a small hand dredge provided with a hessian bag weighted with a stone and sunk from three to five feet below the surface of the water. At the same time a net of fine bolting silk attached to a wire ring on the end of a light pole was swept backwards and forwards through the water in order to catch any specimens which may have been set free during the scraping of the wall.

The sea-weed from the dredge along with the contents of the net was emptied into a bucket of sea-water, well broken up, and thoroughly agitated in order to detach any Medusæ which might be adhering to the sea-weed, etc. The contents of the bucket were then poured off into another vessel through a coarse wire sieve in order to remove the more bulky material. The water with its sediment was next filtered through fine bolting silk. The material caught on the silk was finally washed into a small dish of sea-water and examined with a binocular dissecting microscope provided with a black background. The crawling Medusæ were picked out from among the fine débris by means of a pipette and transferred to small pots of sea-water for further observation.

When searching for the hydroid stage a different method was employed, the sea-weeds being removed straight to glass vessels and worked over with a dissecting microscope. I have not, however, succeeded in tracing the Medusa to the hydroid form.

#### HABITS.

Prior to the publication of Gilchrist's observations on living specimens of *C. capense*, very little was known about the habits of the crawling Medusæ of the Southern Hemisphere. Browne had recorded the interesting fact that *C. callentini* had been observed to swim; and although Vaukhöffen examined and sketched the living animals at Kerguelen Island, he did not refer to their habits beyond the brief mention that his specimens were found crawling over the lobes of the thallus of a sea-weed (*Macrocystis*).

In habits the crawling Medusa from Port Jackson is very similar to the Cape species—the mode of progression, the adhesive power of the tentacles, and the difficulty experienced by the animal in regaining its right position when placed on its back, agree entirely with Gilchrist's description. The latter's remarks on the peculiar jerking movements exhibited by the tentacles when the animal is stationary apply equally well to the form at present under consideration.

The Medusa further agrees in habit with the Cape species since it was never observed to swim; neither could any swimming motion be induced by dropping the specimens into sea-water. They would fall straight to the bottom of the vessel and then move along the surface of the glass by slow crawling movements.

The following observations supplement the published accounts of the habits. During the examination of the living Medusæ in a shallow glass dish on the stage of a microscope the specimens over the area of bright light admitted through the stage aperture were observed to move off to those parts of the dish which were outside the circle of illumination.

The influence of background on the movements of the animal was also noted. Several specimens were placed in a dish of which one-half of the bottom was white, the remainder black. When the dish was so orientated that the two halves were equally illuminated, all the Medusæ gradually passed to the black half.

#### Family CLADONEMIDÆ.

##### Genus CNIDONEMA, *Gilchrist*.

*Cnidonema*, Gilchrist, Quart. Journ. Micro. Sci. (n.s.), lxiii., 4, 1919, p. 525.

The genus *Cnidonema*, with *C. capense* for its type, was founded by Gilchrist for a species of crawling Medusa from the Cape of Good Hope possessing the following characters:—

“Medusa: adapted for crawling or walking; no brood-pouch above stomach; gonads well-developed, in ectodermal inter-radial pockets around stomach; sexes separate; radial canals usually six; tentacles numerous, increasing with age, and not corresponding to number of radial canals, dichotomous; the upper branch with several clusters of nematocysts in addition to a terminal cluster; no oral tentacles; thick nematocyst ring under margin of bell. Hydroid: with one verticil of three capitate tentacles, and a second of six non-capitate tentacles.”

On these generic characters Gilchrist separates the Cape species from the crawling Medusæ (*Eleutheria*) of the Northern Hemisphere. He also maintains as distinct species of the genus *Cnidonema* the previously described crawling Medusæ from the Southern Hemisphere, and establishes Vanhöffen's Kerguelen specimens as a new species, *Cnidonema kerguelense*, characterised by having the nematocyst-clusters lateral in position, the radial canals unbranched, and the nematocyst ring complete.

The propriety of referring all the species of crawling Medusæ from the Southern Hemisphere to the genus *Cnidonema* presents certain difficulties to which Gilchrist has drawn attention. For instance, the hydroid form is known only in the case of *C. capense*, while the ectodermal pouches in which the gonads are partly lodged in the Cape species have not been recognised in the other southern forms except, according to Gilchrist, in the case of the male of *C. kerguelense*. Gilchrist, however, would seem to have somewhat misinterpreted Vanhöffen's remarks on the arrangement of the gonads in the Kerguelen species.

Although its hydroid stage is at present unknown, the Medusa from Port Jackson is referred to Gilchrist's genus *Cnidonema*, and is described as a new species differing in several well-marked characters from the crawling Medusæ of the Southern Hemisphere. The holotype (Reg. No. Y. 586), and slides of serial sections of the Medusa have been deposited in the Australian Museum, Sydney.

I have much pleasure in associating the name of Professor W. A. Haswell with this new species of crawling Medusa from Port Jackson, Australia.

*CNIDONEMA HASWELLI, sp. nov.*

(Pl. xvii., figs. 1-4; Pl. xviii., figs. 1-5.)

*External characters.*—The largest specimen, when fully expanded, measured 3.5 mm. from tip to tip of the tentacles. When viewed from above, the umbrella appears circular with a diameter of 1.2 mm. None of my specimens are as large as the Kerguelen species, which, according to Vanhöffen, measured 5.5 mm. in breadth in the preserved condition. In the Cape species the breadth of the largest male was 3.3 mm.

In a lateral view of the Medusa, the body appears very slightly flattened; it is not so compressed as in either *C. capense*, in which the height is about one-third of the breadth of the body, or in *C. hollysoni*, which is considerably flattened, the height being about one-fourth of the diameter of the disc. In the preserved condition, however, there is a marked change in shape, some of the specimens appearing much more flattened than in life, while others are almost spherical in outline.

There is a considerable degree of variation in the colour exhibited by individuals of different ages. The young Medusæ are not heavily pigmented and hence appear lighter in colour than the mature specimens. When viewed by transmitted light the body of the adult is, in most cases, a reddish-yellow colour, but appears bright red or orange by reflected light. This colouration is due to the presence of masses of pigment-granules in the endodermal cells of the stomach and the circular canal. In the specimen figured (Pl. xvii., fig. 1.) there is in the centre of the disc a large reddish-yellow area, which is roughly octagonal in outline with eight radiations extending to the circular canal. In none of my specimens do these radiations become enlarged into sacular structures such as Gilchrist figures in *C. capense*.

On the exumbrellar surface above the reddish-yellow stomach is an octagonal ring which appears cream coloured when viewed by reflected light. In one specimen the octagonal ring was absent, but eight broad radiations of a deep cream colour were present which extended to the circular canal concealing the radiating lines of the stomach.

The gonads vary in colour from cream to pale yellow and lie around and above the reddish-yellow stomach, leaving only a small circular patch of stomach visible in the centre of the disc.

The ocelli occur on the exumbrellar surface at the bases of the tentacles; they are bright red in colour and are surrounded by a circle of white pigment-granules. A vertical section shows the ocelli, which project slightly on the surface, to be composed of densely packed pigment-granules; a lens is not present.

The tentacles are only very slightly pigmented. Granules of white pigment are grouped in little heaps near the proximal end of the main stem of the tentacle. A row of similar granules extends along the main stem and is continued down the entire length of the lower branch; these white granules are usually absent from the upper branch of the tentacle.

Fixed material is somewhat different in appearance owing to the cream-coloured pattern on the exumbrellar surface, and the white granules of the tentacles disappearing in the preservative.

*The tentacles.*—The tentacles are very variable in number, ranging from six in the youngest individual to about thirty-one in the largest. In adult specimens the arrangement of the tentacles bears no relation to the radial canals, but in the youngest specimen obtained there are six well-developed tentacles arising from the circular canal opposite the ends of the radial canals, which in this particular specimen are six in number. The development of the subsequent tentacles is apparently quite irregular as there are two young specimens in the collection with ten and thirteen tentacles respectively. The growth of a tentacle is fairly rapid, fully formed tentacles being produced on an individual kept under observation, at the rate of one in every three or four days.

Each tentacle consists of a main stem which is divided at its distal end into two branches, a short upper and a longer lower branch. In living and fully expanded adult specimens the lower branch is a little longer than the upper one. The main stem of the tentacle is slightly shorter than the upper branch. In young specimens the lower branch of the tentacle is markedly longer than the upper; and in the youngest individual obtained the lower branch in the fully expanded condition was twice as long as the upper branch of the tentacle. In mature specimens, however, the branches become more equal in length, so that in adult forms the lower is only slightly longer than the upper branch. In *C. capense*, according to Gilchrist, "the upper branch is about three times the length of the lower branch in the living and fully expanded condition." This difference between the lengths of the upper and lower branches of the tentacles serves at once to distinguish *C. haswelli* from the Cape species.

On the upper branch of the tentacle are borne the nematocyst-clusters, which are aboral and oral in position, their arrangement being very similar to that described by Gilchrist in the case of *C. capense*. Owing to the shortness of the upper branch of the tentacle in *C. haswelli*, the nematocyst-clusters are more concentrated in their relative positions than they are in the Cape species.

There is a knob-like terminal cluster of nematocysts, which is followed by a second cluster on the upper or aboral side of the tentacle. This second cluster is separated from the terminal cluster by a short interval; in young individuals the cluster is completely aboral in position, but as

they grow older it extends down a short distance on each side of the tentacle, never, however, reaching so far as to become oral in position. The third nematocyst-cluster occurs on the ventral or oral side of the branch; it is smaller than the second, and is confined entirely to the ventral surface. A fourth cluster is aboral in position and is usually separated from the second by an interval which is either equal to or slightly less than the one which separates the latter from the terminal knob-like cluster. The upper branch of the tentacle is thus armed with four clusters, one terminal, two aboral, one oral; the last lying between the two aboral, but nearer the proximal than the distal.

In all the specimens examined the position of these nematocyst-clusters on the upper branch of the tentacle was found to be constant. In young individuals a small nematocyst-cluster occurs on the dorsal or aboral side of the main stem a short distance from the point where it divides into upper and lower branches, but in most of the adult specimens this cluster is usually absent. It, however, is well developed in one specimen with twenty-four tentacles (Pl. xvii., fig. 1).

Nematocyst-clusters were never observed on the lower branch of the tentacle.

The nematocysts are of two kinds; (1) large oviform nematocysts, their length being 23-25  $\mu$  and their breadth 17-19  $\mu$ ; and (2) smaller, narrowly oval or nearly cylindrical nematocysts, which measure 8  $\mu$  in length and 4  $\mu$  in breadth.

The lower branch of the tentacle, which is used for crawling, ends in a sucker-like extremity. This expanded terminal part is strongly adhesive owing to the presence of glandular cells in the ectoderm, while its sucker-like action is brought about by the arrangement of the muscles in this part. By means of these suckers and the secretion of the glands the animal is able to adhere so firmly to the smoothest surface that it is difficult to detach it.

Fixation of specimens with hot sublimate-acetic causes very little shrinkage of the tentacles; both the upper and lower branches undergo a slight but equal amount of contraction, so that in the preserved state they present almost the same appearance as in the living animal. This is contrary to the condition found in the Cape species, for here, according to Gilchrist, the upper branch of the tentacle, which in the living animal is about three times the length of the lower one, "contracts much more in preservative, and is then only about the length of the lower branch."

The tentacles are hollow outgrowths from the outer wall of the circular canal, the endodermal cells of which pass directly into the endodermal lining of the tentacle. The lumen of the tentacle extends along both the upper and lower branches. In the main stem the endoderm consists of columnar cells, the nuclei of which lie close together near the cell margins which border upon the narrow lumen of the tentacle. The lumen of the lower branch is also very narrow, but the upper branch contains a wide lumen, which is a conspicuous feature in sections through a tentacle.

*Nematocyst ring.*—The thick nematocyst ring is a very conspicuous structure in the form of an uninterrupted cushion of nematocysts under the circular canal. The nematocysts are tensely packed in a continuous ring, which is distinctly marked off from the base of the tentacles. In vertical sections the ring appears oval in outline with its outer margin placed just beneath the circular canal and its long axis directed inwards and downwards. The nematocysts are of two kinds. There are large oviform nematocysts which measure 23-25  $\mu$  in length and 17-19  $\mu$  in breadth. Besides these large forms there are smaller, narrowly oval or nearly cylindrical nematocysts, their length and breadth being 8  $\mu$  and 4  $\mu$  respectively. The two types are similar to those which occur in the clusters of nematocysts on the tentacles.

The nematocyst ring has no connection with the base of the tentacles in any of the species of *Cnidonema*, except *C. hodysoni*, in which the basal portion of each tentacle is covered on its under side with a thick pad of nematocysts.

*Velum.*—The velum is not clearly discernible in the living or preserved whole specimens, but is readily made out in vertical sections when it is seen to be composed of a double layer of ectoderm separated by mesogloea. The ectoderm consists of a layer of much flattened cells. The velum is broad, covering in the whole of the subumbrellar cavity, and is perforated by a circular aperture through which the manubrium may be protruded. The rim of the velar aperture usually fits closely around the manubrium but does not fuse with it; or the velum may become drawn out into a funnel-shaped structure through which the manubrium is protruded so that the mouth is carried well beyond the aperture of the funnel. Sometimes the velum is appressed to the body, at others it is curved outwards thereby considerably enlarging the subumbrellar cavity.

*Alimentary tract.*—The manubrium is a very mobile part of the alimentary tract, and is capable of being extended through the aperture of the velum and protruded for a considerable distance beyond the edge of the umbrella. The mouth is situated at the free extremity of the manubrium. There are no oral tentacles. Around the edge of the mouth the ectoderm forms a thickened ridge, which bears large, well developed nematocysts. The endoderm of the manubrium is thrown into eight ridges which reach their maximum extent about the middle of the manubrial region. These ridges are of a muscular nature and are arranged in the shape of a star with eight rays. The lumen of the manubrium thus presents a stellate appearance in transverse sections through this region. The rays of the star are narrow and acute; in the endoderm between them occur large nematocysts. The cells of the wall of the manubrium are free from pigment-granules. In the upper part of the manubrium the muscular ridges pass into the endodermal ridges of the stomach, while the rays of the star become continuous with the stomach diverticula.

The mouth leads into a large sac-like stomach, which at its widest occupies the greater part of the body. The endoderm of the stomach is of very great thickness and is raised up into eight longitudinal ridges. The endoderm consists of numerous cells heavily laden with pigment-granules.

and gland cells, but no nematocysts such as Gilchrist found in the wall of the stomach of *C. capense*. The gland cells are very widely distributed throughout the endoderm.

The cavity of the stomach is produced into eight angular embayments forming the stomach diverticula, which are narrow, acute-angled pouches lying between the longitudinal endodermal ridges. These diverticula give a very characteristic star-like appearance to transverse sections through the region of the stomach. From the apex of each of the stomach diverticula is given off a short radial canal, which passes directly to the circular canal.

The arrangement of the diverticula in *C. haswelli* agrees exactly with Vanhöffen's figure of a transverse section through a male specimen of the Kerguelen species. In *C. capense*, on the other hand, the stomach diverticula are always six in number and take the form of wide pouches, which are more or less rectangular when fully developed, although in younger specimens they may be small and acute.

The stomach diverticula in *C. haswelli* are eight in number in all except two young individuals, in which there are six and seven respectively.

*Radial canals.*—The radial canals are usually eight in number; of two young individuals, however, one had only six, while the other, which was more mature, possessed seven. The radial canals are very short, and being unpigmented or nearly so, can only be made out with certainty in sections. An examination of the living animal as well as preserved specimens cleared in cedarwood oil did not reveal the true arrangement of these canals. Owing to the stomach diverticula reaching almost to the circular canal, there is, in the whole specimens, an appearance of pigmented radial canals; in sections, however, the apices of these diverticula are seen to communicate with the circular canal by very short radial canals, the endodermal lining of which is devoid of pigment-granules.

The number of radial canals present in the several species of *Unidomena* varies very considerably. In the case of *C. callentini*, Browne states that "according to Mr. Vallentin, the Falkland species has four radial canals," and that *C. charcoti* (Bedot) is distinguished from all the other crawling Medusæ of the Southern Hemisphere "by the radial canals having slender lateral branches with a tendency towards anastomosis." The latter statement by Browne is based presumably on his examination of specimens of *Wandelia charcoti* received from Professor Bedot.

The radial canals of *C. hodgsoni* are variable in number. Browne found that out of six specimens examined, three had eight radial canals and the remaining three had six, ten and eleven canals respectively. Vanhöffen does not state the number of radial canals present in the Kerguelen specimens, but an inspection of his figure of a transverse section through a male shows eight radial canals. He describes, however, the endoderm of the stomach as forming six, eight or ten folds which come into communication with the circular canal by short radial canals. This arrangement of the stomach diverticula would seem to indicate that the radial canals are also variable in number, and are

represented in his several specimens by six, eight or ten canals respectively. Gilchrist found the radial canals of *C. capense* to be invariably six in number.

*Circular canal.*—The circular canal, which is a prominent feature in vertical sections of the Medusa, is wide and lies directly above the nematocyst ring. The endoderm of the outer wall of the circular canal consists of columnar cells the nuclei of which lie close together near the cell margins, which border upon the lumen of the canal. These columnar cells pass over directly into the endodermal lining of the tentacle.

The endoderm of the inner wall of the circular canal is formed of small cells which contain pigment-granules. These cells pass directly into the endoderm cells of the radial canals, which, however, are unpigmented, and so come into relation with the endoderm of the stomach.

The pigment-granules lodged in the cells of the inner wall of the circular canal form a ring of pigment, the inner margin of which is well defined. Its outer margin is irregular and sends projections into the columnar endoderm cells of the outer wall of the circular canal. These projections lie in the intervals between the bases of the tentacles, and do not extend into the endodermal lining of the tentacles, which as a consequence are unpigmented.

*Gonads.*—The sexes are separate. The gonads were studied in both male and female Medusæ by means of serial sections cut in two directions, vertically and transversely. The gonads are very well developed and are lodged in the subumbrellar cavity. They occupy almost the whole of the subumbrella, extending from the velum upwards alongside of the stomach and to a considerable extent above it. They do not, however, extend to the apex of the body, but leave a small circular area above the stomach quite devoid of gonads.

The gonads form a ring around the stomach below the radial canals and extend upwards into the subumbrellar space where they are separated for a short distance by vertical partitions of ectoderm, above which they unite once more to form a continuous ring around the stomach. There is no brood-pouch above the stomach.

The arrangement of the gonads in *C. haswelli* is thus associated with the radial canals and their relation to the subumbrellar cavity. The radial canals are short and are given off from the stomach diverticula at a very low level. Consequently there is a large subumbrellar space, lined throughout by ectoderm, between and above the radial canals. This ectodermal lining of the subumbrellar cavity comes into contact above and below the radial canals and so forms low vertical partitions composed of a double layer of ectoderm and a middle one of mesoglea.

The partitions below the radial canals extend downwards for a very short distance. Those above the radial canals are developed to a greater extent, but are not carried up to the apex of the subumbrella as in *C. capense*, where they form complete septa between the gonads, so that the ovaries or testes come to occupy six pouches or vertical diverticula of the subumbrellar cavity. The arrangement of the gonads in *C. haswelli* thus differs considerably from that described by Gilchrist in the Cape species.



In transverse sections through a male of *C. haswelli* at the level of the ectodermal partitions above the radial canals, the testes are seen to be reduced to inter-radial masses, each of which is partly cleft by a vertical slit into two adradial portions lying in the angle between the stomach diverticula. Vanhöffen describes and figures a similar arrangement of the testes in the Kerguelen species, and the same condition is shown in Gilchrist's figures of transverse sections through a male Medusa.

In the female of *C. haswelli*, the ovaries occupy a corresponding position in the subumbrellar cavity to that occupied by the testes in the male. The ovaries, however, show no trace of segregation into two adradial parts. The ova are closely packed together and, when mature, measure 0.06 mm. in diameter. In the females of the Kerguelen species, Vanhöffen found scarcely any trace of segregation of the ovaries into two adradial parts although he suspects that originally the ovaries were separate, and that later, through the growth of the ova, they became merged for lack of space.

Gilchrist has apparently misinterpreted Vanhöffen's remarks on the arrangement of the gonads in *C. kerguelense*. Gilchrist writes:—"Whether or not such partitions between the gonads exist in other southern Elentheria is not known, except in the case of the male of Vanhöffen's species. The females of this species do not appear to have them, though Vanhöffen suspects they may be present in the young females." Vanhöffen, however, does not mention the presence of partitions or septa between the gonads in the Kerguelen species; his remarks refer simply to the tendency in the male for the testes to occur as two adradial portions, which are united by a narrow bridge of ectoderm *in the angle* ("in dem Winkel") between the stomach diverticula. Gilchrist has evidently mistaken this bridge of ectoderm ("Ektodermbrücke") for a septum; the true septa, however, are clearly figured by Vanhöffen on Plate xxxi, fig. 5c, where they are shown as double folds of ectoderm with a middle one of mesogloea.

*Asexual reproduction.*—Besides producing gonads, *C. haswelli* multiplies asexually by budding, the buds arising from the circular canal between the tentacles and the nematocyst ring. Gilchrist found medusa buds occupying a similar position in young specimens of the Cape species. Although the buds were not observed in living specimens of the Medusa from Port Jackson, transverse sections of a male revealed six, all of which have reached about the same phase of development. Only very young buds are present and these consist of hollow outgrowths which are nearly cylindrical or slightly tapered at their distal ends. The ectoderm of the bud is composed of several layers of cells. The endodermal cells, in which pigment-granules are recognisable, are arranged in a single uniform layer lining the narrow lumen of the bud.

*Affinities.*—The Medusa from Port Jackson has been referred to the genus *Unidonema*, on account of its crawling habits; the absence of a brood-pouch above the stomach; the distinct sexes; the numerous tentacles, which increase with age and do not correspond in number with the radial canals; the dichotomous tentacles, the upper branch of which carries several

clusters of nematocysts in addition to a terminal cluster; the absence of oral tentacles; the presence of a thick nematocyst ring under the margin of the bell. The gonads are well developed and are partly separated by low ectodermal septa. Crawling Medusæ of this type have hitherto been recorded only from the Falkland Islands, the Cape of Good Hope, Kerguelen Island, and Antarctica. The discovery of a new species on the coast of New South Wales is, therefore, of special interest. The species is a well-marked one, and differs considerably from the previously-described members of the genus. It is readily distinguished from *C. charcoti*, *C. kerguelenense*, and *C. hollysoni*, by its nematocyst-clusters, which are oral and aboral in position; from *C. callentini* by its gonads not being entirely above the stomach; and from *C. capense* by (*a*) the upper branch of the tentacle being shorter than the lower branch, (*b*) the radial canals, which are usually eight in number, (*c*) the shape of the stomach diverticula, which are narrow, acute-angled pouches, and (*d*) the poorly-developed septa between the gonads.

#### KEY TO THE SPECIES OF THE GENUS *Uridonema*.

- a.* Nematocyst-clusters oral and aboral in position.
  - b.* Gonads entirely above stomach.....*C. callentini* (Browne).
  - bb.* Gonads not entirely above stomach.
    - c.* Upper branch of tentacle longer than lower branch.....*C. capense*, Gilchrist.
    - cc.* Upper branch of tentacle shorter than lower branch.....*C. hasecelli*, sp. nov.
- aa.* Nematocyst-clusters lateral in position.
  - d.* Radial canals branched.....*C. charcoti* (Bedot).
  - dd.* Radial canals not branched.
    - e.* Complete nematocyst ring.....*C. kerguelenense*, Gilchrist.
    - ee.* Incomplete nematocyst ring.....*C. hollysoni* (Browne).

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# STUDIES IN AUSTRALIAN CARCINOLOGY.

No. 1.

BY

FRANK A. MCNEILL, Assistant in Zoology, Australian Museum.

(Plate xix., and Figures 1-5.)

The following paper deals with *Uca marionis*, and extends the known range of several other Australian crustaceans. The former is represented in the Australian Museum collection by several large series of specimens, which afford an opportunity to give a few notes on the variation and characters of the species. For assistance in the formation of the paper I am indebted to Mr. A. R. McCulloch, whose tuition in the past has laid the foundation of my work.

## Family OCYPODIDÆ.

*UCA*, Leach.

*UCA MARIONIS*, Desmarest.

(Plate xix., and Figures 1-5.)

*Gelasimus marionis*, Desmarest, Consid. Gen. Crust., 1825, p. 124, pl. xiii., fig. 1. *Id.*, Milne Edwards, Ann. Sci. Nat., Zool. (3), xviii., 1852, p. 145, pl. iii., fig. 5. *Id.*, Kingsley, Proc. Acad. Nat. Sci. Philad., 1880, p. 141, pl. ix., fig. 8. *Id.*, Alcock, Journ. Asiat. Soc. Beng. (n.s.), lxix. 2, 1900, p. 359. *Id.*, De Man, Abh. Senck. naturf. Ges., xxv. 3, 1902, p. 487.

*Gelasimus vocans*, Milne Edwards (part), Ann. Sci. Nat., Zool. (3), xviii., 1852, p. 145, pl. iii., fig. 4. *Id.*, Haswell, Cat. Austr. Crust., 1882, p. 92. *Id.*, De Man, Notes Leyden Museum, xiii., 1891, p. 23, pl. ii., fig. 5.

*Gelasimus nitidus*, Dana, U.S. Expl. Expd., Crust., part 1, 1852, p. 316, pl. xix., figs. 5a-d.

*Gelasimus cultrimanus*, Kingsley, Proc. Acad. Nat. Sci. Philad., 1880, p. 140, pl. ix., fig. 7.

*Gelasimus vocans*, var. *cultrimanus*, De Man, Notes Leyden Museum, xiii., 1891, p. 24, pl. ii., fig. 5a.

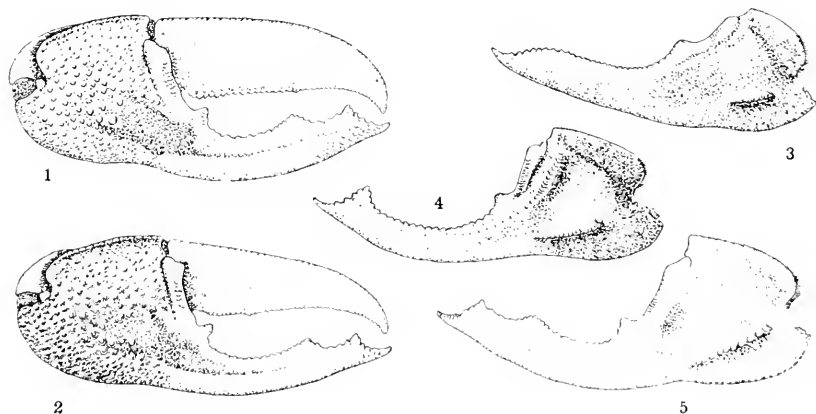
Hess<sup>1</sup> has incorrectly recorded *Gelasimus signatus* and *G. variatus* (= *tetragonum*) from Sydney, but no species of the genus is known to occur so far south as Port Jackson. I am now able to record the presence of *Uca* in New South Wales' waters, however, a fine series of *U. marionis* having been recently collected by Mr. J. R. Kinghorn on a lagoon mud-flat near South West Rocks, Trial Bay.

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<sup>1</sup> Hess—Arch. Naturg., xxxi. i., 1865, p. 146.

*Variation*.—A splendid series of 150 male specimens in the Australian Museum collection exhibits a remarkable range of variation in the form of the larger hand, which is illustrated in the accompanying figures. They include the typical *marionis* form as illustrated by Desmarest, Milne Edwards, and Kingsley; the var. *nitida* form as figured by Dana, and the forms illustrated in figs. 5 and 5a of De Man as *G. vocans* and *G. vocans* var. *cultrimanus*, and also similar variation to that described by the latter author in 1902 (*vide supra*). The intermediate stage between *marionis* and var. *nitida*, as figured by Milne Edwards, is not represented in our collection, but an additional variety, which I propose to call *romeris*, is represented by many specimens from Australia.

*Uca marionis*, var. *typica* (Plate xix., and Fig. 3).—In this variety the movable finger is very blade-like, and is subequally toothed along the whole of its inner edge. It is more delicate and slender in some specimens than in others, and is sometimes nearly straight along its cutting edge. The immovable finger is scarcely excavate and there are no angular projections anteriorly, but a broad low one occurs near the base; the cutting edge forms a shallow sinuous curve. The crests on the inner surface of the palm are not so prominent as those in the other varieties;



Figs. 1 and 2. Chelae of adult males of var. *nitida*, from Fiji.

Fig. 3. Inner surface of palm of adult male of var. *typica* from the Endeavour River estuary at Cooktown, Queensland; same specimen as Fig. 10, on Plate xix.

Fig. 4. Inner surface of palm of adult male of var. *romeris*, from Trial Bay, New South Wales; same specimen as Figs. 1-3 on Plate xix.

Fig. 5. Inner surface of palm of adult male of var. *nitida*, from Fiji; same specimen as text fig. 1.

there is a short clearly defined one on the lower surface of the palm, and another near the base of the immovable finger which is irregular in form. This may be obscurely divided into two in some specimens, while in others the two merge to form a low, wide ridge of granules; in others again, this ridge is obsolete.

*Uca marionis*, var. *romeris*, var. nov. (Plate xix., and Fig. 4).—Intermediate between var. *typica* and var. *nitida* is a form common in sub-tropical Australia. In this the base of the immovable finger is armed with a small

acute lobe, which is more pronounced in some specimens than in others, and the distal portion becomes elevated into a large angular lobe. The cutting edge of the finger is generally more or less deeply excavate, though it may be nearly straight, particularly in the younger stages. The mobile finger is less blade-like than in var. *typica*; it is provided with one or two enlarged denticles which are variable in position, there being either one in the middle of the finger-length, or one on the proximal or distal half, or on both. A set of slightly enlarged denticles may also occur at the base. The crest on the lower inner surface of the palm is long and very prominent, and there are two well differentiated ones at the base of the immovable finger.

*Uca marionis*, var. *rocaus* M. Edw. (*nec*. Linn).—Milne Edwards has figured a male chela, which is intermediate between that of var. *romeris* and var. *nitida*, in which the inner edge of the immovable finger tends to form a median projection and thereby approaches the form of var. *nitida*.

*Uca marionis*, var. *nitida*, Dana (Figs. 1, 2 and 5).—In this form the immovable finger is armed with the usual proximal angular lobe; there are also two prominent angular projections, one distal in position, while the other is either submedian or in the distal half of the finger. The movable finger is usually rather thickened and curved, and is provided with one or more enlarged denticles which vary, as in var. *romeris*; a series of enlarged denticles may also occur at the base. The two well defined inner crests of the palm are very prominent, the third is either very small or is obsolete.

Though these variations differ so considerably from the typical form, the series before me includes most of the intermediate stages connecting one with another, while the fact that two forms, such as var. *typica* and var. *romeris*, and var. *typica* and var. *nitida*, are represented in collections from circumscribed areas convinces me that they are all referable to the one species.

*Localities*.—Trial Bay, New South Wales; coll. J. R. Kinghorn, Jan. 1920—var. *romeris* and stages intermediate between var. *romeris* and var. *typica*.

Brisbane River, Queensland—adult male (large hand missing).

Fraser Island, Queensland—var. *romeris*.

Eudeayour River estuary at Cooktown, Queensland; coll. A. R. McCulloch, June, 1918—var. *typica*, var. *romeris*, and stages intermediate between the two.

Kollan Island, King Sound, North-west Australia; coll. Dr. H. Basedow, 1916—var. *romeris*, and stages intermediate between var. *romeris* and var. *typica*.

Oubatche, New Caledonia—var. *nitida*.

Port Moresby, New Guinea—var. *nitida*.

New Hebrides—var. *nitida*, and stage intermediate between var. *romeris* and var. *typica*.

Solomon Islands—var. *nitida* and stages intermediate between var. *comeris* and var. *typica*.

Fiji—var. *typica* and var. *nitida*.

Andaman Islands, Indian Ocean—var. *nitida*.

### Family XANTHIDÆ.

#### Sub-family MENIPPINÆ.

PSEUDOCARCINUS, *Milne Edwards*.

PSEUDOCARCINUS GIGAS, *Lamarek*.

*Cancer gigas*, Lamarek, Hist. Nat. Anim. sans Vert., v., 1818, p. 272.

*Pseudocarcinus gigas*, M. Edw., Hist. Nat. Crust., i., 1834, p. 409. *Id.*, Haswell, Cat. Austr. Crust., 1882, p. 52. *Id.*, Miers, Chall. Rept., Zool., xvii., 1886, p. 141 footnote. *Id.*, Whitelegge, Proc. Roy. Soc. N.S.Wales, xxiii., 2, 1889, p. 227. *Id.*, McCoy, Prodr. Zool. Viet., Dec. xviii., 1889, p. 293, pls. clxxix. and clxxx.

The recent acquisition of a specimen enables me to definitely record *Pseudocarcinus gigas* from New South Wales' waters. Furthermore, Mr. A. R. McCulloch has supplied me with some notes made by him in the early part of 1914, whilst on the Federal Trawler "Endeavour," on the colouration and occurrence of the species.

*Colouration*.—While the "Endeavour" was trawling eastward of Babel Island, Bass Strait, in 60-100 fathoms, each haul of the net brought up one or more of this species. Their colouration varied from a beautiful red and white reticulate pattern to a deep red, but the variation was not connected with either sex or age. The comparison of differently marked specimens failed to reveal any structural differences.

*Occurrence*.—Some medium sized examples were found inside large sponges, while a very small specimen, little more than one inch across the carapace, together with another a little larger, was taken out of a large sponge cavity.

*Measurements*.—According to Haswell, the carapace of this species is sometimes two feet in breadth, but I am unable to find any record of specimens attaining that width. The largest specimen in the Australian Museum measures 326 mm. across the carapace at its greatest breadth, and the hand is 442 mm. long from the postero-inferior angle of the palm to the tip of the immovable finger; its weight when fresh was twenty pounds. Another large example in the Tasmanian Museum, Hobart, is about 13 inches (330 mm.) across the carapace, and the hand is about 17½ inches (438 mm.) in length, measured as above.

*Locality*.—According to Lamarek, this species was collected in Port Jackson, New South Wales, by Péron and Lesueur, while Whitelegge, on the authority of Trebeck, has included it in a Port Jackson list from the Lane Cove River. We now know the species to be an inhabitant of moderately deep water, and it only ascends to lesser depths in southern latitudes.

It therefore appears to be improbable that any specimen has been taken within the limits of Port Jackson. I am able to definitely record the species from New South Wales' waters, however, a carapace 262 mm. wide and two chelae having been presented to the Australian Museum by Mr. D. G. Stead, which were secured near the Five Islands, off Wollongong, in 75 fathoms.

### Family INACHIDÆ.

#### Sub-family INACHINÆ.

##### EPHIPPIAS, *Rathbun*.

##### EPHIPPIAS ENDEAVOURI, *Rathbun*.

*Ephippias endeavouri*, Rathbun, Biol. Res. "Endeavour," v. I, 1918, p. 9, pl. xv.

*Variation*.—A male specimen, 105 mm. long from the tip of the rostral spines to the end of the posterior tubercle of the carapace, differs from the holotype in being much less massive. The rostral spines are proportionately slightly longer and are more divergent. The chelae are much more slender in proportion and the fingers weaker.

*Locality*.—This specimen was taken by the State Trawlers in about 60 fathoms, off Botany Bay, New South Wales. The species has hitherto only been recorded from south of Kangaroo Island, Investigator Strait, South Australia.

### Family GRAPSIDÆ.

#### Sub-family SESARMINÆ.

##### HELICE, *de Haan*.

##### HELICE LEACHII, *Hess*.

*Helice leachii*, Hess, Arch. Naturg., xxxi. i., 1865, p. 153. *Id.*, De Man, Zool. Jahrb., Syst., ii., 1887, pp. 690, 702. *Id.*, Rathbun, Mem. Mus. Comp. Zool., xxxv. 2, 1907, p. 36.

*Helice pilimana*, A. M.-Edw., Nouv. Arch. Mus. Hist. Nat., ix., 1873, p. 313, pl. xviii., figs. 1 a-c.

This species was originally described from Port Jackson by Hess, but it has not since been recognised from this locality. There is, however, a single specimen in the Australian Museum collection which agrees with De Man's description of the typical example. This was collected in Mosman Bay, Port Jackson, New South Wales, by Mr. Thomas Whitelegge. Further, a fine series of specimens was collected in January, 1920, by Mr. J. R. Kinghorn at Trial Bay, New South Wales, on a mangrove mud flat. All of these specimens agree with those recorded by Miss Rathbun from Japan in having the longitudinal ridge on the lower outer surface of the palm less prominent, and the patch of fur at the base of the fingers less extensive than is shown in A. Milne Edwards' figure of *H. pilimana*.

## STUDIES IN AUSTRALIAN REPTILES.

No. 1.

BY

J. ROY KINGHORN,

Assistant in charge of Herpetology, Australian Museum.

(Plate xx., and Figures 1-7.)

The acquisition by the Australian Museum of a specimen of *Denisonia suta*, Peters, bearing six young in an advanced stage of development, enables me to discuss the status of several species of the genus hitherto regarded as distinct. This very interesting specimen was secured by Mr. W. W. Froggatt, Government Entomologist, at Willow Tree, New South Wales, and I have been able to compare it with the holotype of *D. frontalis*, Ogilby, which is preserved in the Australian Museum.

I wish to acknowledge assistance from Mr. H. A. Longman, Director of the Queensland Museum, who has examined the holotype of *D. frontalis* var. *propinqua*, De Vis, for me, and has further supplied valuable information and suggestions concerning the specimens under his charge. I am also very grateful to Mr. A. R. McCulloch of the Australian Museum for his very willing assistance and advice.

*DENISONIA SUTA*, Peters.

(Plate xx., and Figures 1-7.)

*Hoplocephalus sutas*, Peters, Monatsb. Akad. Berlin, 1863, p. 234.

*Hoplocephalus frenatus*, Peters, *loc. cit.*, 1870, p. 646.

*Hoplocephalus frontalis*, Ogilby, Proc. Linn. Soc. N.S.Wales (2), iv, 3, 1889, p. 1027.

*Hoplocephalus stirlingi*, Lucas and Frost, Rept. Horn Sci. Exp. Cent. Aust., Zool., ii., 1896, p. 149, pl. xii., fig. 5.

*Denisonia suta*, Boulenger, Brit. Mus. Cat. Snakes, iii., 1896, p. 339. *Id.*, Waite and Longman, Rec. S.Aust. Mus., i, 3, 1920, p. 176, fig. 34.

*Denisonia frenata*, Boulenger, Brit. Mus. Cat. Snakes, iii., 1896, p. 338.

*Denisonia frontalis*, Boulenger, *loc. cit.*, p. 340.

*Denisonia frontalis* var. *propinqua*, De Vis, Ann. Queensland Mus., No. 6, 1905, p. 51.



*Synonymy*.—Having compared the descriptions of the above species, together with thirty representatives of *D. suta*, *D. frontalis* and *D. stirlingi*, I have come to the conclusion that all are referable to the one species. Evidence of the identity of *D. suta* and *D. frontalis* is afforded by a fresh specimen containing six well developed young in its oviducts which exhibit features characteristic of both species, while an analysis of all the specimens labelled as *D. suta* and *D. frontalis* in the Australian Museum collection verifies this evidence.

An authentic specimen, received by the Australian Museum from the Horn Expedition collection labelled *Hoplocephalus stirlingi*, proves to have the same characters as the type of *D. frontalis*. According to Lucas and Frost's description, this species has the temporal shields  $1 + 2$ , but this is evidently erroneous since their figure and the specimen before me show them to be  $2 + 2$  as in *D. suta* and *D. frontalis*. The identity of *D. stirlingi* and *D. frenata* has already been noted by Boulenger.<sup>1</sup>

Finally, it will be shown below that *D. frontalis* var. *propinqua* is based upon an abnormal specimen, and is to be united with *D. suta*.

#### VARIATION.

*The Nasal and Preocular Shields*.—Two specimens were collected at Willow Tree, New South Wales, and were found within a few yards of each other. They were of exactly the same size and were marked alike, but one had the nasal separated from the preocular as in *D. frontalis*, while the other, the female carrying the six young, had the extreme point of the nasal in contact with the preocular though not forming quite such a broad suture as in a typical *D. suta*. The six unborn young varied as follows:—Three had a very definite and broad point of contact between the nasal and preocular shields, which is characteristic of *D. suta*; two had the nasal widely separated from the preocular, thereby allowing the prefrontal to form a suture with the second upper labial, the character of *D. frontalis*; while one had the shields in contact on one side of the head and separated on the other, thereby bearing the characters of both *D. suta* and *frontalis*. These facts should prove that this character is no longer of any value to separate the two species.

The same variation may be found in a more or less marked degree throughout the total number of specimens examined; some have the two shields widely separated, thereby allowing the prefrontal to form a suture with the second upper labial; some have them forming a broad suture at their point of contact, while in others there is only the merest point of contact; a few in the Australian Museum and the Queensland Museum collections have the shields in contact on one side of the head and separated on the other, thereby combining the characters hitherto assumed to separate the two species.

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<sup>1</sup> Boulenger—Zoological Record, xxvii., 1896, Reptilia, p. 27.

The position of the nasal in relation to the preocular in *D. frontalis* in comparison with a specimen which most nearly agrees with the description of *D. suta*, is illustrated in the accompanying figures.

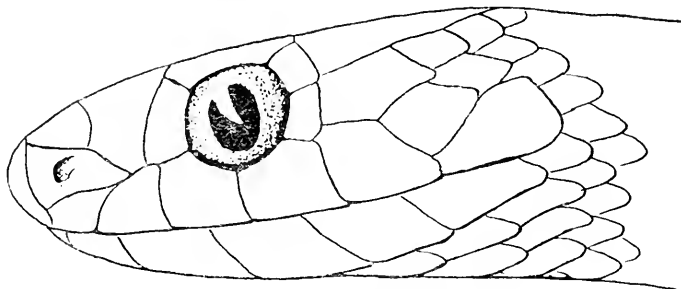


Fig. 1. Showing relationship of nasal to preocular in the type of *Demosoma frontalis*.

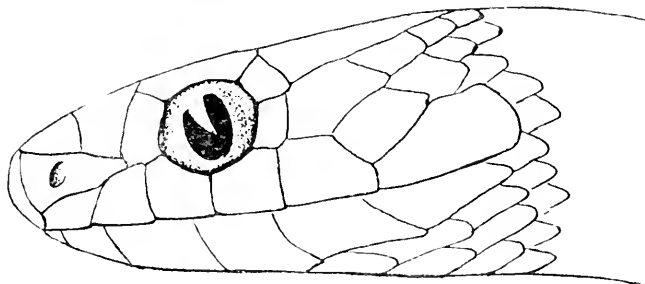


Fig. 2. Showing relationship of nasal to preocular in *Demosoma suta*.

*Chin Shields*.—Another character formerly used to distinguish the two species is whether the anterior chin shields are as long as (*D. suta*) or larger than (*D. frontalis*) the posterior. This also proves to be of no value, since it is inconstant, and the difference, where it exists, is extremely small; in some specimens the posterior and in others the anterior chin shields are slightly the larger, but they are most often equal in length. In some cases there is a slight difference in the shape of the two shields, and this, unless a measurement be taken, may make one appear to be longer than the other. A very young living specimen<sup>2</sup>, from Willow Tree, New South Wales, which agrees most nearly with *D. suta* in all other respects, has the posterior chin shields longer than the anterior.

<sup>2</sup> This specimen also was collected by Mr. W. W. Froggatt, Govt. Entomologist, and presented to the Australian Museum on August 14th, 1920. It bears evidence of having been born in midwinter as the umbilicus is very plainly visible to the naked eye.

*The Eye.*—The original description of *D. suta* states "eye longer than its distance from the mouth" while that of *D. frontalis* describes the eye as small. I find that in Ogilby's holotype of *D. frontalis*, and in all other specimens referable to that form, the diameter of the eye is twice its distance from the mouth, and similar to that of *D. suta*.

*The Internasals and Prefrontals.*—On comparing the description of *D. frontalis* var. *propinqua*, De Vis, with those of *D. frontalis* and *D. suta*, I failed to find any reason why it should be separated from those species. De Vis states "internasals (semifused with the prefrontals) apparently as large as the prefrontals." Mr. Longman has kindly examined De Vis' holotype in the Queensland Museum for me, however, and he writes "the prefrontals and internasals in De Vis' *propinqua* are certainly abnormal, and should *frontalis* be merged into *suta*, var. *propinqua* should follow."

I have found throughout the series examined that the internasals and prefrontals vary slightly in their relative sizes and are not sufficiently constant to afford a distinguishing character.

*The Temporals.*—The temporal shields are, with one exception,  $2 + 2$ , and the anterior pair are longer than the posterior, behind which are several enlarged scales. Of the anterior temporals the upper is generally the larger, but in some specimens both shields are about the same size; the lower anterior is always wedged in between the fifth and sixth upper labials.

The specimen which has more than  $2 + 2$  temporals is figured as Fig. 3 and it will be seen that this superimposed shield takes the place usually occupied by the upper part of the fifth upper labial.

This character is shown on each side of the head, but it is an unusual one.

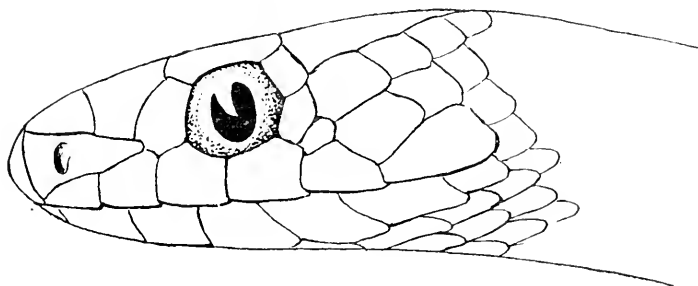


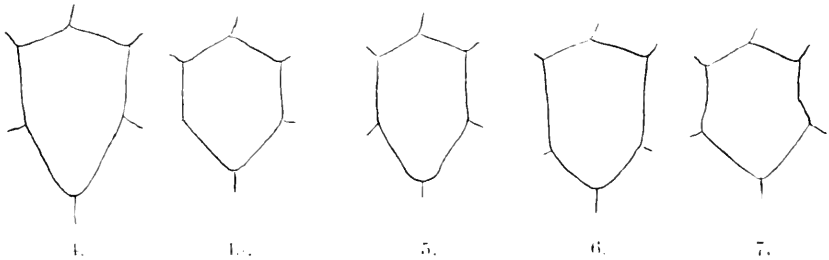
Fig. 3.

*Frontal Shield.*—In his key to the species of the genus *Denisonia*<sup>3</sup> Boulenger indicates that *D. frontalis* has the frontal nearly twice as long as

<sup>3</sup> Boulenger—Brit. Mus. Cat. Snakes, iii., 1896, p. 333.

broad, and not much broader than the supra-ocular; Peters' original description however, gives the measurement as "frontal  $4\frac{2}{5}$ ," which means that it is once and three-fifths as long as broad. In my specimen of *H. stirlingi*, which species is considered synonymous with *H. frenata* by Boulenger, the frontal is once and a third as long as broad.

Examination of all the other specimens on hand shows that the frontal varies in being from one and one-fifth to one-and-a-half times as long as broad, and it is nearly always twice as broad as the supra-ocular. An extraordinary range of variation in the shape of the frontal shield is illustrated in the accompanying figures: the difference between that of the female as compared with one of its young is especially notable.



Variations in the shape of the frontal shield.

FIG. 4. The female from Willow Tree, N.S.W.

FIG. 4a. An embryo from the above.

FIG. 5. A variety intermediate between 4 and 6.

FIG. 6. Normal variety possessed by the majority of specimens examined.

FIG. 7. An abnormal variety.

*The Ventral and Subcaudal Shields.*—In the description of *D. sata* the number of ventral shields is stated to be 157-164, and the sub-caudals 25-30; *D. frontalis* is described as having ventrals 154, sub-caudals 30. In my series the specimens which agree with *D. sata* have the ventrals 144-160 and the sub-caudals 27-35, a total of 175-193; while those of *D. frontalis* form have the ventrals 147-172 and the sub-caudals 26-39, a total of 174-207.

*Tabulation of Main Characters.*—The specimens referred to in the following table are selected as being representative of the thirty-six examined by me: the characters of the remainder vary slightly in intermediate stages between these. For convenience of comparison I have added the corresponding characters from the descriptions of the types of the various species.

According to the several descriptions, the characters listed in the table were the main features used to separate the various species, but it will be seen that none are sufficiently constant to maintain the species they have been supposed to characterise.

	Relationship of Nasal to Preocular.	Anal.	Rows of Scales	Ventrals	Sub- Ventral caudal	Total Ventral S.C.	Chin Shields	Frontal
	Broad contact.	Entire	19	144	31	175	Posterior longer	$1\frac{1}{2}$ as long as broad, twice as broad as supra-ocular
	Slight contact.	"	19	158	28	186	Anterior longer	$1\frac{1}{2}$ "
	Broad contact.	"	19	160	33	193	Equal length	14 "
	Contact on left side, no contact on right side.	"	19	155	31	186	Equal length	14 "
	No contact.	"	19	172	35	207	Equal length	$1\frac{1}{2}$ "
	Very slight contact.	"	19	153	27	180	Anterior longer	$1\frac{1}{2}$ "
	No contact.	"	19	147	27	174	Equal length	$1\frac{1}{2}$ "
	No contact right side, contact left side.	"	19	165	33	198	Posterior longer	13 "
	No contact.	"	19	164	39	203	Posterior longer	$1\frac{1}{2}$ " almost
	Contact.	"	19	151	33	187	Posterior longer	14 " twice
	No contact.	"	19	154	30	184	Anterior longer	14 "
	No contact.	"	19	161	30	191	Equal length	13 "
	No contact, but nearer than in <i>D. frontalis</i> .	"	19	163	33	196	Equal length	13 "
	No contact.	"	19	158-176	31-35			13 "
	No contact.	"	19	167	35	202		13 "
	Contact.	"	19	157-164	25-30		Equal length	$1\frac{1}{2}$ "

*Colour markings.*—The colour marking of the ventral shields was originally described as yellowish or white in *D. sata*, and pearly-white with a broad bronze-coloured median band in *D. frontalis*. The following analysis will show, however, that this colour marking has no value as a specific character.

Of thirty specimens examined (not counting the six embryos) sixteen agreed most nearly with *D. frontalis*. Three of these, including the type, have a distinct median band; three have very slight traces of a median band; one has the ventrals darkly blotched transversely, while nine have clear ventrals as in *D. sata*.

Of six specimens which agree most nearly with *D. sata*, three have clear ventrals, one has a distinct median band, and two have slight traces of the median band.

The remaining eight specimens I regard as intermediate forms: three of them have the nasal and preocular in contact on one side of the head and separated on the other: these all have clear ventrals. Five specimens show a very slight contact between the two shields, and of these, two have clear ventrals, two have a slight trace of a median band, while one has the ventrals darkly blotched transversely.

The six embryos also have the ventrals darkly blotched transversely, like their mother.

The colour markings on the head and nape are fairly constant, and full details of them will be found on the last page.

*Definition of Denisonia sata* based upon the specimens and descriptions referred to in the preceding pages:—

Diameter of the eye twice its distance from the mouth. Pupil vertically elliptic or round. Rostral much broader than deep, just visible from above. Internasals about half the size of and shorter than the prefrontals; both shields are broader than long. Frontal once and four-fifths to twice as broad as the supra-ocular, and once and one fifth to once and three fifths as long as broad, a little longer than its distance from the end of the snout, shorter than the parietals. Nasal entire; either in contact with the preocular, or separated from it by the junction of the second upper labial with the prefrontal. Two post oculars; temporals  $2 + 2$ , the lower anterior of which is wedged in between the fifth and sixth upper labials. Six upper labials, the third and fourth entering the eye. Three lower labials are in contact with the anterior chin shield, which is about equal in length to the posterior. Scales in 19 rows. Ventrals 14-172. Total ventrals and sub-caudals 174-207. Anal entire, sub-caudals single, 26-39.

*Colour.*—Light brown above, scales narrowly margined with black or dark brown. A broad dark nuchal collar extending onto the head; top of head dark brown, merging into yellow or white on the sides. Side of the head with a black irregular band which arises on the rostral shield and passes through the nostril and lower half of the eye to the lower post

ocular, thence it extends to the mouth at the junction of the fifth and sixth upper labials where it rises again till it joins and forms the lower border of the nuchal collar. A dark vertebral line is often present, but it may be rather feebly marked. Lower parts yellowish or white, with or without a broad bronze-coloured median line; occasionally the inner edge of the ventral shields are darkly blotched transversely.

*Localities.*—The localities of the various types are as follows:—

*Denisonia guta*, Peters, Southern Australia.

*Denisonia frenata*, Peters, Lake Elphinstone, Queensland.

*Hoplocephalus stirlingi*, Lucas and Frost, Central Australia.

*Denisonia frontalis*, Ogilby, Narrabri, New South Wales.

*Denisonia frontalis* var. *propinqua*, De Vis, Queensland.

The localities of all the specimens in the Australian Museum are widely separated, the majority being from North-Western New South Wales; one is from Forbes, Western New South Wales; and three are from Sylvania, Queensland. A specimen has lately been recorded from Moolooloo, South Australia.<sup>4</sup>

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<sup>4</sup> Waite & Longman—Rec. South Aust. Mus., i, 3, 1920, p. 176.

# NOTES ON AUSTRALIAN MAMMALS.

No. 1.

BY

ELLIS LE G. TROUGHTON,

Assistant in charge of Mammals, Australian Museum.

(Figures 1-6).

The following notes record extensions in the range of two Australian mammals, together with remarks on a resting place of the "Little Bat," *Eptesicus pumilus*, Gray, and an extended description of the "Allied Rat," *Epimys assimilis*, Gould.

I wish to express my thanks to my colleague, Mr. J. R. Kinghorn who kindly prepared the accompanying figures, and Mr. A. R. McCulloch for his helpful advice since handing over the Department of Mammals to my charge and during the preparation of this paper.

## Family VESPERTILIONIDÆ.

*CHALINOLOBUS MORIO*, Gray, and *EPTESICUS PUMILUS*, Gray.

The only indigenous mammal hitherto listed from Lord Howe Island is the bat recorded by Etheridge<sup>1</sup> as *Chalinolobus morio*, Gray. His record was based upon a single specimen collected by his party in 1889, and which does not appear to have been preserved, since it cannot now be found although I have searched carefully through the Microchiroptera in the collection of the Australian Museum. As *Chalinolobus morio* is found in both New Zealand and Australia, however, it probably occurs at the intermediate locality, Lord Howe Island.

After carefully comparing a series of six bats in the Australian Museum collection from Lord Howe Island, which do not differ from a large series of *Eptesicus pumilus*, Gray<sup>2</sup>, from various localities in Australia, I am able to definitely record the occurrence of this species on the island.

It may be noted here that, on a recent expedition in South Australia I collected two specimens of *Eptesicus pumilus* from Tulka, near Proper Bay, which is eight miles from Port Lincoln on Eyre's Peninsula. Both specimens were found under the loose bark of the native "She Oak" (*Casuarina glauca* or *suberosa*), about six feet above the ground, and not far from a road bordered by blossoming trees which provided a surfeit of insect-food. When finished hunting the bats apparently sought shelter on trees of which the bark curled out sufficiently loosely from the trunk

<sup>1</sup> Etheridge—Mem. Austr. Mus., ii., 1889, p. 6.

<sup>2</sup> Vide Gould—Mamm. Austr., iii., 1863, pl. xlv.



to provide adequate room without exposing them to the weather. This choice of shelter was probably due to the fact that the Mallee scrub in this locality did not provide any large hiding places, or the rock formation any caves. The resting places were probably chosen at random, there being nothing to indicate that they were regularly inhabited.

### Family MURIDÆ.

#### *EPIMYS ASSIMILIS*, Gould.

As stated by Mr. Edgar R. Waite, very few of our native rats have been described by other than external characters and a revision of the Australian Muridæ is so greatly needed that any effort towards the completion of specific descriptions will be welcomed. To this end Mr. Waite published his "Extended description of *Mus fuscipes*, Waterhouse,"<sup>3</sup> and with his excellent example before me I venture to supply additions to our knowledge of the characters and range of *Epimys assimilis*, Gould.

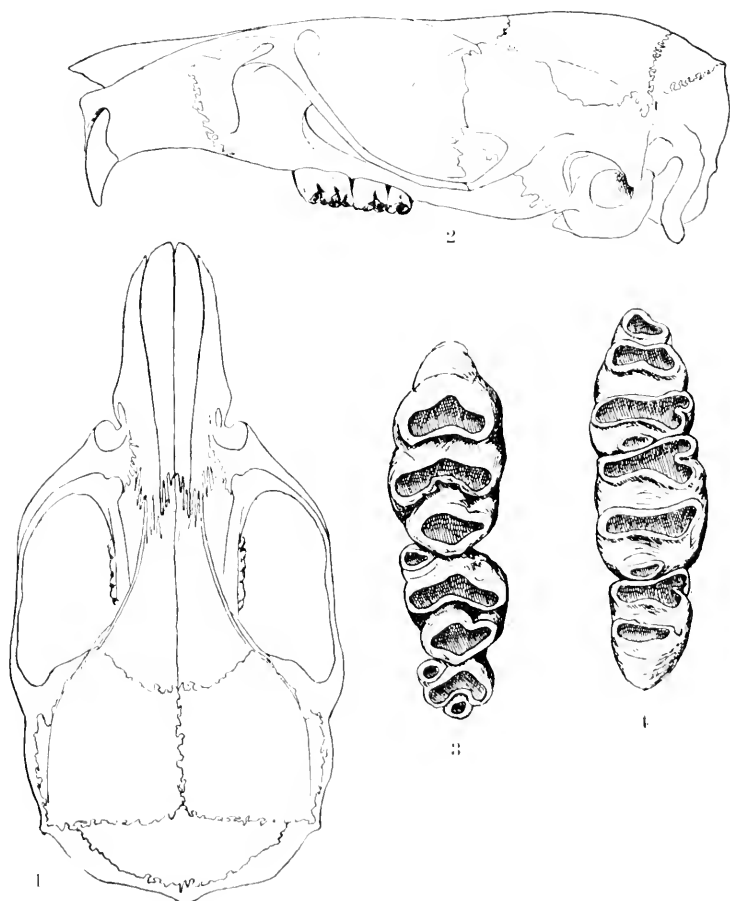
*Description*.—Fur long, soft and extremely thick; on the back it is an admixture of slate-coloured fur tipped with light brown and longer hairs which are brightly iridescent in sunlight; the bases of the long hairs are light greenish-grey to the length of the fur, and the remaining portions are either wholly black or tipped with pale brown. The light brown tips of the fur and the black and brown of the longer hairs produce the "light brown pencilled with black" effect described by authors. The sides are lighter, merging into the greyish-buff under surface which is produced by the lighter slate-colour of the basal fur with its dull white tips. Feet covered with fine, silvery-white hairs.

Ears larger than those of *fuscipes*; laid forward they reach to, or a little beyond the posterior margin of the eye; pinna thin, covered sparsely but evenly with light brown hairs externally, and silvery to light brown hairs internally. Comparative measurements of twenty-four specimens show the tail to be extremely variable in length; in measurements of fresh specimens, taken from the rump at a point where the tail can be bent upwards, to its tip, three specimens have it from 1.8 mm. shorter than the head and body, while in twenty-one specimens it is from 1.26 mm. longer than the head and body; it is sparsely but evenly covered with short hairs which are dark brown with lighter tips and are generally longer than two scales but not concealing them.

*Skull*.—Rounded compared with *E. norregicus* but not so stout as *fuscipes*, the nasal region appearing more slender than in the latter species. Supraorbital ridge not very marked and not forming a pronounced ridge. The anterior palatina foramina extend backwards to the centre of the first cusp of the first molar. Interparietal comparatively longer than that of *fuscipes*, its length being generally about half its breadth. Though, when comparing skulls of *assimilis* and *fuscipes*, the stouter appearance of the latter is quite obvious, a comprehensive series of comparative

<sup>3</sup> Waite-Ree, Austr. Mus., iii., 1900, p. 190, figs. 1-4.

measurements of both species prove the bones of the skull to be most variable, the apparent differences merging into one another, so that a detailed list of measurements seems superfluous.



*Epimys assimilis.*

FIGS. 1 AND 2. Skull of adult.

FIG. 3. Upper molar teeth of same specimen.

FIG. 4. Lower molar teeth of same specimen.

*Teeth.*—Anterior edges of upper incisors orange, the colour varying in intensity; lower incisors paler. The molars are relatively finer than those of *fuscipes*, the tooth rows of *assimilis* being actually shorter and narrower than those of the former species in skulls of equal length. Upper molars tapering from the first to a comparatively small third molar; there is a distinct external lobe on the third cusp of  $m^1$  and  $m^2$ , formed by an angular fold of the anterior margin of each; there is no

sign of this lobe or fold in *fuscipes*. Mandible and teeth decidedly more delicate than those of *fuscipes* in skulls of equal length. The lower molars afford a striking and consistent difference between the two species in the following character: on the posterior margin of  $m^1$  there is a small facet or subsidiary cusp (Fig. 4) pressing closely against the anterior margin of the following molar, and there is a similar facet on the posterior margin of  $m^2$ ; there is no trace of any such facets on the posterior margins of these teeth of *fuscipes* (Fig. 6).



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*Epomys fuscipes*.



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Fig. 5. Upper molar teeth (after Waite).

Fig. 6. Lower molar teeth of another specimen.

*Comparison of external characters with those of E. fuscipes.*—The fur of *assimilis* is much thicker, the basal colour lighter, and it is not so harsh to the touch as that of *fuscipes*; it has no trace of the yellowish tinge of the latter species. Ears of *assimilis* longer, reaching to the posterior margin or middle of the eye instead of half way to it as in *fuscipes* (vide Waite). The tail of *fuscipes* is noticeably shorter than that of *assimilis* and is consistently shorter than the head and body in the specimens I have examined; measurements of three specimens given by Waterhouse<sup>4</sup> and Waite show the tail to be 57 mm. shorter than the head and body while in a specimen measured by myself, the tail measured from the rump, is 30 mm. shorter; it is therefore proportionately much shorter than the shortest tail of *assimilis* in comparison with its head and body. There are 30 caudal vertebrae in the only skeleton of *assimilis* examined, counting from behind the two broad sacral vertebrae articulating with the ilia, and possibly including several pseudo-sacral vertebrae; under the same conditions I count 27 caudal vertebrae in a skeleton of *fuscipes*.

*Range.*—*E. assimilis*, hitherto considered quite rare, was originally recorded from the Clarence River, New South Wales, and King George's

<sup>4</sup> Waterhouse—Zool. Voy. Beagle, i. 2, 1839, p. 66, pl. xxv.

Sound, Western Australia, by Gould<sup>5</sup> and its known range has since been extended to south-west of Rockhampton, Queensland, by Collett<sup>6</sup>. Specimens, in the Australian Museum, collected by myself and others enable me to note the occurrence of this rat at several intermediate localities. I recently collected a fine series on Kangaroo Island, South Australia, which enables me to record the occurrence of the species, hitherto only known from the mainland, on the island. These specimens do not exhibit any striking differences from the mainland specimens. They were caught in traps baited with raisins, on a rocky hillside near Birchmore Lagoon, a stretch of brackish water about 15 miles from Kingscote, and along the banks of a dry watercourse, known as Deep Creek, 20 miles from Kingscote.

Two specimens collected on the Tulka sand dunes, in very dry country, about 10 miles South of Port Lincoln, Eyre's Peninsula, South Australia, reflect their sandy environment in a slightly lighter colouration.

Unlike *E. fuscipes*, water does not seem essential to *E. assimilis*, as the localities in which both the Kangaroo Island and Eyre's Peninsula specimens were secured were generally some considerable distance from it, which suggests that the species goes for long periods, if not altogether, without water. I have also trapped it in the Megalong Valley, about two miles from Blackheath, on the Blue Mountains, New South Wales, where it favoured damper surroundings than in South Australia, being on a hillside and near a creek where there is considerable soakage of water at times. Other specimens are in the Australian Museum collection from Jerriwangler Creek, Wandandian, New South Wales, collected near water by Mr. A. R. McCulloch; Mount Kosciuszko (5,600 ft.), New South Wales; the Herberton District, Queensland.

<sup>5</sup> Gould—Proc. Zool. Soc., 1857, p. 241, and Mamm. Austr., iii., 1863, pl. xv.

<sup>6</sup> Collett—Zool. Jahr. (Syst.), ii., 1887, p. 838.



EXPLANATION OF PLATE XVII.

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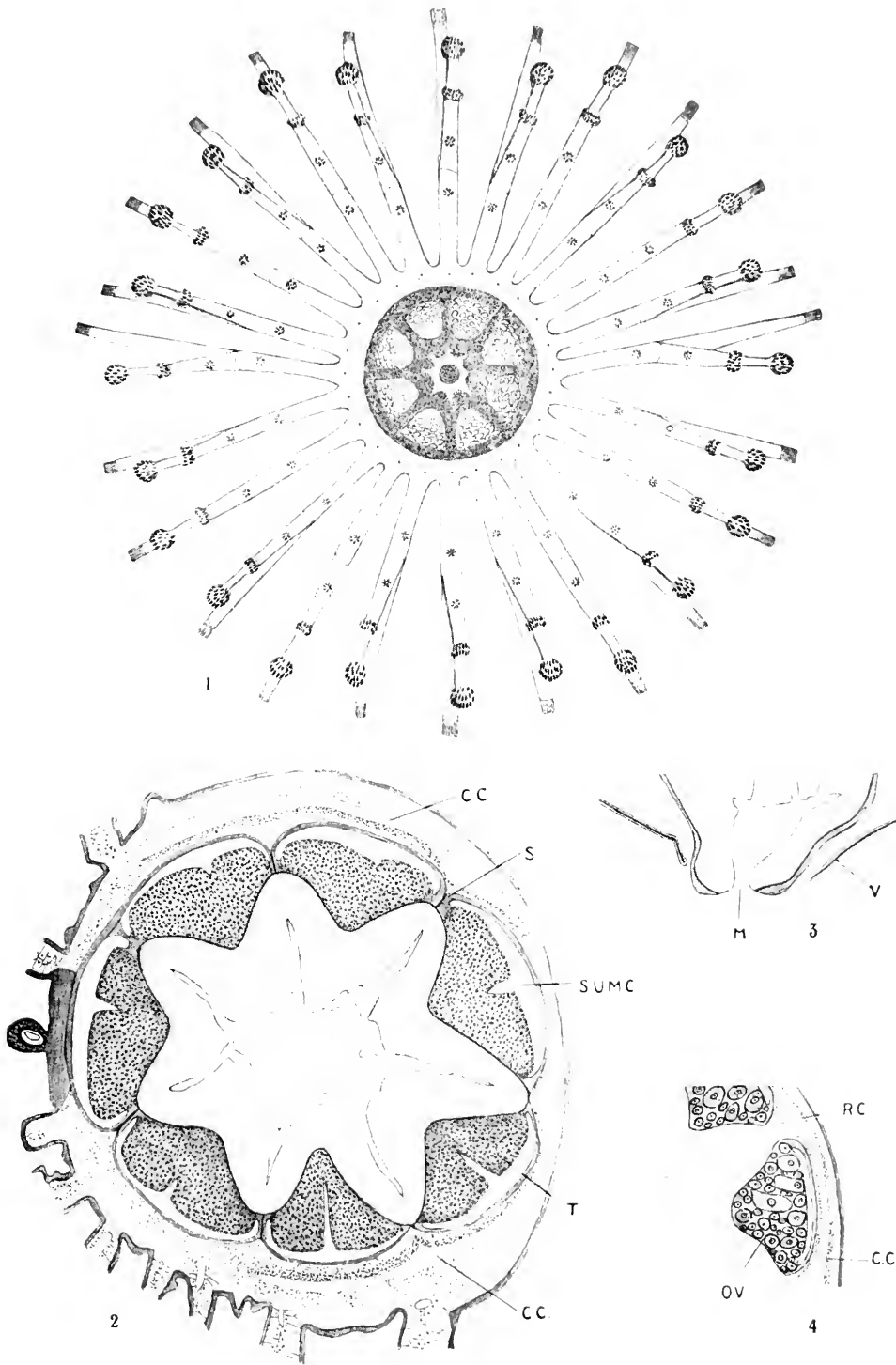
*Uridonema haswelli*, Briggs.

REFERENCE LETTERS.

*c.c.*, Circular canal. *m.*, Mouth. *ov.*, Ovary. *r.c.*, Radial canal. *s.*, Septum. *s. um. c.*, Subumbrellar cavity. *t.*, Testis. *v.*, Velum.

Fig. 1. Mature Medusa viewed from above, with tentacles fully expanded.

- .. 2. Male Medusa: transverse section passing through the circular canal (*c.c.*) on the right, and below the circular canal on the left. The section shows the septa (*s*) separating the testes at a level just below the radial canals. The cavity of the stomach is shown produced into seven angular embayments forming the stomach diverticula.  $\times 74$ .
- .. 3. Vertical section passing through the mouth (*m.*) at the free extremity of the manubrium, which is protruded through the aperture of the velum (*v.*).  $\times 74$ .
- .. 4. Female Medusa: transverse section passing through the ovary (*ov.*), a radial canal (*r.c.*), and the circular canal (*c.c.*).  $\times 74$ .



EXPLANATION OF PLATE XVIII.

*Cnidonema haswelli*, Briggs.

REFERENCE LETTERS.

*c.c.*, Circular canal. *n.r.*, Nematocyst ring. *r.c.*, Radial canal. *s. umb. c.*, Subumbrellar cavity. *t.*, Testis. *v.*, Velum.

- Fig. 1. Male Medusa; micro-photograph of a vertical section passing through inter-radial region.  $\times 64$ .
- „ 2. Male Medusa; vertical section passing through inter-radial region. The section shows the testes (*t.*) occupying almost the whole of the subumbrellar cavity, extending from the velum (*v.*) upwards alongside of the stomach and to a considerable extent above it.  $\times 64$ .
- „ 3. Male Medusa; micro-photograph of a transverse section passing through the circular canal on the right, and below the circular canal on the left.  $\times 64$ .
- „ 4. Male Medusa; vertical section passing through a radial canal (*r.c.*) on the right.  $\times 64$ .
- „ 5. Male Medusa; transverse section above the stomach showing the testes (*t.*) in the form of a continuous ring.  $\times 64$ .

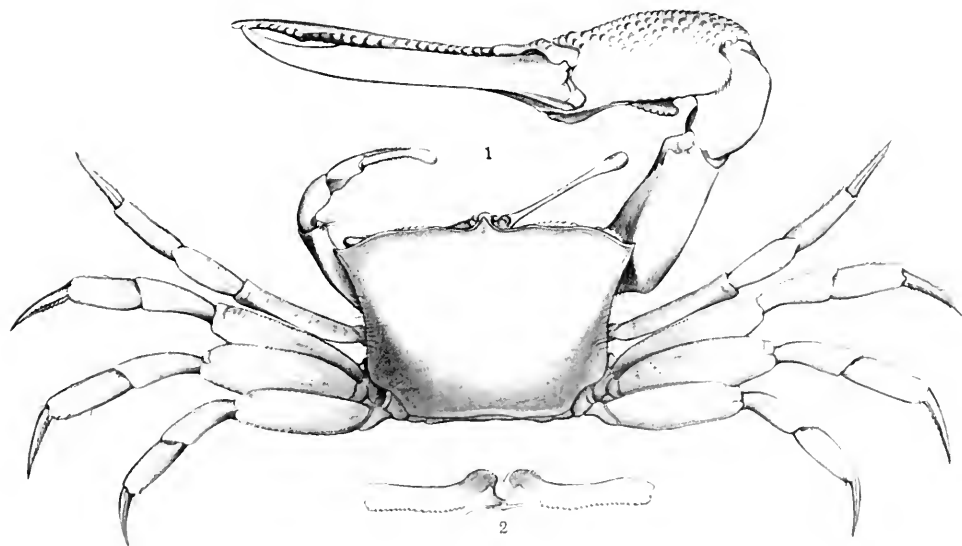
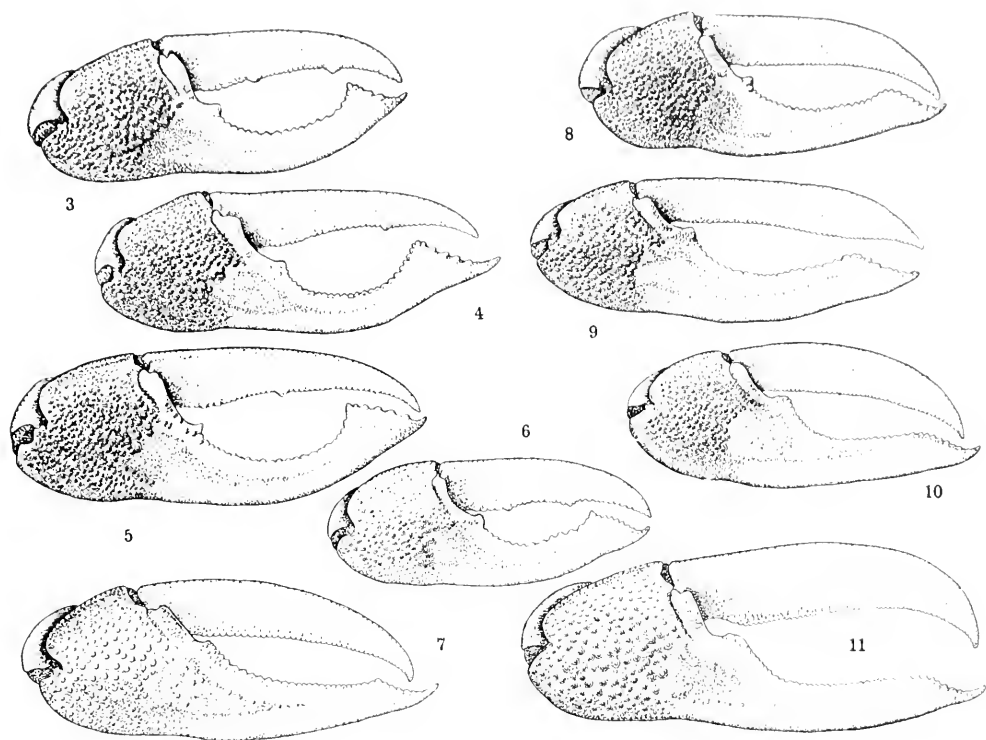




EXPLANATION OF PLATE XIX.

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- Fig. 1. *Uca marionis*, Desm., var. *romeris*, var. nov. An adult male, 26 mm. wide at the outer angles of the orbits, from Trial Bay, New South Wales.
- „ 2. Front and orbits of the same specimen as Fig. 1.
- „ 3. Chela of the same specimen as Fig. 1.
- „ 4. Chela of an adult male of var. *romeris*, from Trial Bay, New South Wales.
- „ 5. Chela of an adult male of var. *romeris*, from Trial Bay, New South Wales.
- „ 6. Chela of a half grown male of var. *romeris*, from the Endeavour River estuary at Cooktown, Queensland.
- „ 7. Chela of an adult male, intermediate between var. *romeris* and var. *typica*, from the Solomon Islands.
- „ 8. Chela of an adult male, intermediate between var. *romeris* and var. *typica*, from Trial Bay, New South Wales.
- „ 9. Chela of an adult male, intermediate between var. *romeris* and var. *typica*, from Trial Bay, New South Wales.
- „ 10. Chela of an adult male of var. *typica*, from the Endeavour River estuary at Cooktown, Queensland.
- „ 11. Chela of an adult male of var. *typica*, from Fiji.





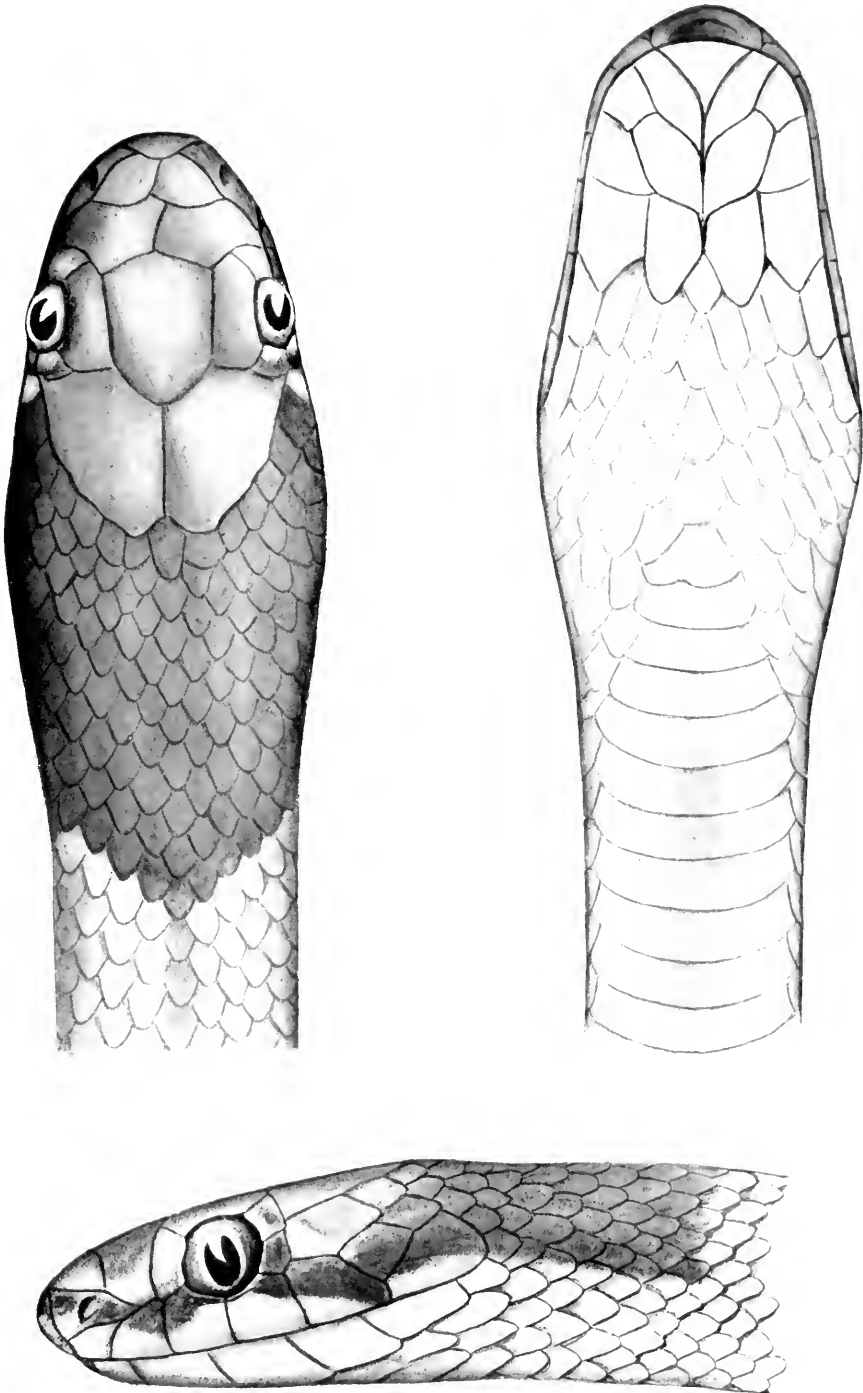


EXPLANATION OF PLATE XX.

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*Denisonia suta*, Peters.

Drawn from the type specimen of *Denisonia frontalis*, Ogilby. Narrabri,  
New South Wales.







## STUDIES IN AUSTRALIAN FISHES.

No. 7.\*

BY

ALLAN R. McCULLOCH, Zoologist, Australian Museum.

(Plates xxi.-xxiv. and Figure I.)

### Family PLOTOSIDÆ.

Genus EURISTHMUS, *Ogilby*.

*Euristhmus*, Ogilby, Proc. Linn. Soc. N.S.Wales, xxiv., 1, 1899, p. 154  
(*Plotosus elongatus*, Castelnau).

This genus is distinguished from *Cuidoglanis*, Günther, by the wide isthmus which separates the gill-membranes; its axillary pore is also much smaller than that of *C. megastomus*.

*EURISTHMUS LEPTURUS*, *Günther*.

Long-tailed Catfish.

(Plate xxi., fig. 1).

*Cuidoglanis lepturus*, Günther, Brit. Mus. Cat. Fish., v., 1864, p. 28.

D.  $i/4$ ; P.  $i/11$ ; V. 12. Depth before the ventral fins 1.3 in the length of the head, and 8.5 in the length to the hypural joint; head 6.3 in the same. Head and body 2.1 in the length of the tail. Eye 3.07 in its distance from the end of the snout, and 2.3 in the interocular space, which is 3.6 in the head. Dorsal spine 2.5, pectoral spine 3.0 in the head. Dorsal fin 2.1, pectoral fin 1.9, and ventral fin 2.7 in the head.

General form slender, the tail elongate. Head somewhat depressed, its breadth 1.2 in its length. Nasal barbels about four-fifths as long as the head, and longer than the maxillary pair. Two pairs of mandibular barbels, the outermost of which are longest. Snout rounded, projecting far beyond the mandible. Lips thick and plicate, the lower forming a free fold near each angle of the mouth which is narrower than the interspace between them; posterior angle of the mouth not reaching the vertical of the anterior margin of the eye. Anterior nostril a simple opening near the upper lip, the posterior slit-like and opening on the outer base of the nasal barbel. Surface of the head with numerous minute pores. Preopercular margin completely hidden beneath the skin, the opercular edge indicated by a fold. Gill-openings wide but separated by a broad interspace on the isthmus which is almost as wide as the interocular space.

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\* For No. 6, see "Records," xiii., pt. 2, 1920, p. 41.

A small group of six or seven stout conical teeth on each side of the premaxillary symphysis, the anterior of which are largest. A row of strong conical teeth around the mandible followed by a band of smaller ones. A wide and somewhat crescentic band of molariform teeth on the vomer.

Dorsal spine inserted a short distance behind the head, its hinder edge serrated; the fin is about half as long as high and somewhat pointed, and almost reaches the origin of the second dorsal when laid back. Second dorsal less than half as high as the first, decreasing backwards, and united with the tail. Anal similar to the second dorsal. Ventrals originating a trifle behind the vertical of the commencement of the second dorsal; their margins are rounded, and they reach the anal origin when laid back. Pectorals rounded, a little longer than the first dorsal; the spine is feebly serrated.

Lateral line commencing in a group of pores on the shoulder and forming a curve above the pectoral, after which it extends along the middle of the body and tail. Axillary pore minute, opening at the anterior end of a glandular area above the base of the pectoral fin. A large dendritic appendage is present behind the vent.

*Colour*.—Brown above, lighter below, and obscurely mottled with lighter areas on the tail. Soft dorsal and anal fins with darker borders.

Described and figured from a specimen 363 mm. long from the estuary of the Hawkesbury River, New South Wales, which was caught and presented to the Australian Museum by Dr. Mark C. Lidwill. Others are in the collection from the Parramatta River estuary.

### FAMILY MONOCENTRIDÆ.

#### GENUS CLEIDOPTUS, *De Vis*.

*Cleidopus*, De Vis, Proc. Linn. Soc. N.S.Wales, vii., 1882, p. 367 (*gloria maris*).

This genus differs from *Monocentris*, Bloch & Schneider, in having a patch of vomerine teeth, a luminous organ on each side of the mandible, and the suborbital bone linear instead of broad.

#### CLEIDOPTUS GLORIA-MARIS, *De Vis*.

(Plate xxiii., fig. 1).

*Cleidopus gloria-maris*, De Vis, Proc. Linn. Soc. N.S.Wales, vii., 1882, p. 368.

*Monocentris gloria-maris*, Ogilby, Proc. Linn. Soc. N.S.Wales, xxiv., 1899, p. 163. *Id.*, Waite, Mem. Austr. Mus., iv., 1, 1899, p. 67, pl. viii., figs. 1-2.

This species has been described in detail by Ogilby, and further considered by Waite in the papers quoted above. It is not uncommon in depths of about forty fathoms off the coast near Port Jackson, where it is taken by trawlers. Specimens placed in a tub of water by the fishermen

have been observed to cast a gleam of light ahead from each mandibular luminous organ, which circumstance has earned for the species the popular title of "Port and Starboard Light Fish."

*Variation*.—Six specimens 145-210 mm. long, from New South Wales and two from Western Australia exhibit variation in the number of scutes, those from the east having fourteen to fifteen in a row from the shoulder to the base of the tail while the western examples have thirteen to fourteen. The dorsal spines of the western specimens are smaller than those of the east, but as the specimens are apparently similar in all structural details, it is probable that they are referable to the one species.

*Localities*.—New South Wales coast, and Fremantle, Western Australia.

### Family MUGILIDÆ.

#### Genus MUGIL, *Linnaeus*.

Through the kindness of the Director of the Queensland Museum, I have been able to examine the holotypes of some of Ogilby's species of this genus, and to compare them with allied species. The following key indicates their relationship and their principal distinguishing characters.

- a. An anterior and posterior eyelid.
  - b. 8 anal rays; about 40 scales between operculum and hypural joint ..... *dohola*.
  - bb. 9 anal rays; 29-34 scales between operculum and hypural joint.
    - c. End of mandible exposed when the mouth is closed; pectoral fin shorter than or equal to distance between the opercular margin and the anterior orbital edge. No distinct dark axillary spot.
      - d. About 30 scales between operculum and hypural joint.
        - e. First dorsal spine reaching more than half its distance from base of last dorsal ray ..... *dussumieri*.
        - ee. First dorsal spine not reaching half its distance from base of last dorsal ray. Dorsal and anal fins almost completely covered with scales ..... *ladopsis*.
      - cc. End of mandible almost or entirely hidden below the pre-orbital when the mouth is closed. Pectoral at least as long as the space between opercular edge and anterior margin of orbit. A pronounced dark axillary spot.
        - f. Cheek-scales finely ctenoid; 30-32 scales between operculum and hypural joint. Body-scales without distinct membranous borders. Their surface sculpture being continued to the edge. Dorsal and anal rays not hidden by scales. First dorsal spine nearer the hypural joint than the end of the snout ..... *georgii*.
        - ff. Cheek-scales cycloid; 33-34 scales between the operculum and the hypural joint. Each body-scale with a membranous border which is not sculptured like the surface of the scale. Dorsal and anal rays largely hidden by scales. First dorsal spine nearer the end of the snout than the hypural joint ..... *longimanus*.

*MUGIL DUSSUMIERI* (Cuv. & Val.) Day.

(Fig. 1).

*Mugil dussumieri*, Cuvier & Valenciennes, Hist. Nat. Poiss., xi., 1836, p. 147. *Id.*, Day, Fish. India, 1876, p. 352, pl. lxxiv., fig. 2. *Id.*, Stead, Proc. Linn. Soc. N.S.Wales, xxxi., 1906, p. 60, and Add. Fish. Faun. N.S.Wales, 1907, p. 7, and Ed. Fish. N.S.Wales, 1908, p. 42. *Id.*, Weber, Nova Guinea, v., 1907, p. 243.

*Mugil nepalensis*, Günther, Brit. Mus. Cat. Fish., iii., 1862, p. 424, (*vide* Day).

*Mugil stercens*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 19.

Characters of the holotype of *M. stercens*, Ogilby, which is incomplete and in a very imperfect state of preservation. D. iv., i/8? A.? P. i/15; V. i/5; C.? 29 or 30 scales between the operculum and the hypural joint, and 12 in an oblique row from between the dorsal fins to the belly.

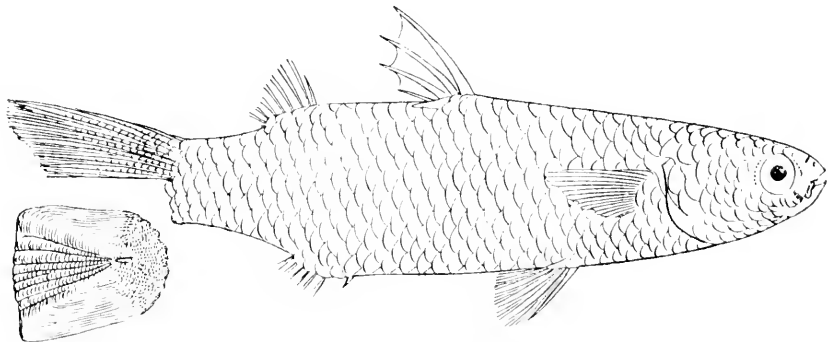


Fig. 1—*Mugil dussumieri*, Cuvier & Valenciennes, Holotype of *M. stercens*, Ogilby, with an enlarged figure of a scale from the middle of the side.

Maximum depth 3·7 in the length to the hypural joint, and a little greater than the length of the head which is 3·8 in the same. Orbit 3·5 in the head, and 1·3 in the bony interorbital width, which is 2·6 in the head. First dorsal spine 1·3 in the head.

Adipose eyelids well developed though rather narrow, the posterior broader than the anterior. Premaxillaries missing; one maxilla remaining which indicates that its end may have been exposed when the mouth was closed. Mandibles incomplete, their margins sparsely ciliated. Vomer and palatines toothless. Preorbital coarsely denticulate on its external and posterior margins. Exposed surfaces of all the scales finely rugose, scarcely any concentric rings being visible, and their edges are ciliated; those of the cheeks are rugose and ciliated also, and are arranged in five rows between the eye and the subopercular margin.

Dorsal spines very strong and long, the first inserted a trifle nearer the hypural joint than the anterior margin of the eye; its adpressed tip reaches much more than half the distance between its base and that of the last dorsal ray. Dorsal and anal fins very imperfect and entirely denuded of scales.

The specimen is bleached, and there is no trace of a dark axillary spot.

Length to the hypural joint 139 mm. Head  $35\frac{1}{2}$  mm. Maximum depth between the dorsal fins 37 mm., but the specimen is evidently somewhat distorted. Orbit 10 mm., interorbit  $13\frac{1}{2}$  mm., and first dorsal spine 26 mm.

*Synonymy*.—Ogilby noted the relationship of *M. stercus* and *M. dussumieri*. Having critically compared his holotype with an Indian example of the latter species from Dr. Day's collection, I am unable to find any characters to separate the two; the differences noted by Ogilby prove to be very slight and insufficient to maintain his species. The depth is 3·7 in *stercus* and 3·8 in *dussumieri*, and there is no appreciable difference in the forms of the snouts of the two. *M. dussumieri* has the upper jaw ciliated as was described by Ogilby, and the mandibles of the two specimens are similar. Odd scales remain on the snouts of both specimens and indicate no difference in this character. The eye is 3·5 in the head in *stercus* and 3·8 in *dussumieri*, while an apparent difference in the interorbital width is due to the fact that Ogilby measured the interocular instead of the true interorbital space. The point of the insertion of the first dorsal spine is similar in the two specimens. Ogilby described the maxillaries as concealed: only a portion of one now remains which does not enable one to see whether it is concealed or not, but its end may well have been exposed when the mouth was closed as in *M. dussumieri*.

Ogilby included *M. dussumieri* in the synonymy of *M. subviridis*, but as his conclusions were based upon Day's descriptions of the typical specimens of both species, which were maintained as distinct by that author, further proof of their identity is necessary. The characters of both have been tabulated by Weber, (*loc. cit.*).

*Localities*.—The holotype of *M. stercus* was taken at Gold Island, Rockingham Bay, Queensland, and the Indian example in the Australian Museum is from Madras. Stead has recorded *M. dussumieri* from the Clarence River estuary, New South Wales, but his identification was not altogether satisfactory and needs verification.

#### MUGIL TADOPSIS, Ogilby.

Brown-banded Mullet.

(Plate xxii., fig. 2).

*Mugil tadopsis*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 27.

D. iv, i/8; A. iii/9; P. 16; V. i/5; C. 14. 29-31 scales between the operculum and the hypural joint, and 12 between the back and the belly before the first dorsal exclusive of the median dorsal and ventral rows.

Depth before the first dorsal fin 3·8 in the length to the hypural joint; head 4·5 in the same. Eye 4 in the head, slightly shorter than its distance from the premaxillary symphysis, and 1·7 in the interocular space, which is 2·4 in the head. Least depth of the caudal peduncle 1·6, second dorsal spine 1·5, and pectoral fin 1·2 in the head.

Lower profile of the head and body more strongly arched than the upper. Head slightly broader than deep. Snout rounded in the horizontal plane, its upper profile forming an almost straight oblique line with that of the head and fore part of the body to the origin of the dorsal fin. Upper lip almost vertical, each ramus about one-third as deep as long, with a row of minute ciliæ on the edge; mandible very thin, without teeth, its rami meeting at a wide angle, and with a pit at the symphysis. Maxilla exposed when the mouth is closed, and reaching backward to slightly behind the vertical of the posterior nostril. Preorbital notched at the angle of the mouth, its inferior and posterior borders denticulated; its upper surface with a few scales. Adipose eyelids well developed but not encroaching upon the pupil. Cheek-scales in four rows below the eye, microscopically ctenoid and rugose exteriorly; those covering the preopercular margin are interrupted by several shallow naked mucous canals. Scales cover the snout almost to the margin of the lip, and extend over the mandible.

Body-scales microscopically ciliated, appearing cycloid to the naked eye. They are largest on the middle of the sides and smallest on the caudal peduncle; their free-edges are membranous but sculptured like the rest of the scale. No distinct axillary scales, but the exobasal scales of the ventral and first dorsal fins are well developed. The soft dorsal and anal fins are almost completely covered with scales, as are also the bases of the pectoral and caudal fins while small scales extend up between their rays.

First dorsal spine inserted nearer the snout than the hypural joint, and above the ninth or tenth body-scales; the second spine is longest but reaches less than half its distance from the middle of the second dorsal. Soft dorsal imperfect, originating above the nineteenth or twentieth body-scale; the space between the origins of the two dorsal fins is much greater than the length of the head. Anal imperfect, originating below the eighteenth body-scale and terminating behind the middle of the dorsal fin; its base is about one and two-thirds in its distance from the hypural joint. Pectoral fin reaching the seventh body-scale and terminating far in advance of the vertical of the first dorsal spine. Ventral inserted below the hinder third of the pectoral and very slightly nearer the snout than the origin of the anal; it reaches backward to below the third dorsal spine. Caudal imperfect, emarginate.

Brown after preservation in formaline, darker above, with traces of brown bands along each scale-row.

Described and figured from a specimen 264 mm. long to the end of the middle caudal rays, which has been definitely labelled by Ogilby as the type of the species. Its second dorsal, anal, and caudal fins are imperfect, so these have been completed in the figure from another specimen, in which also the colour-marking is as illustrated.

*Affinities*.—This species differs from *M. tale*, Forskal, as described and figured by Klunzinger<sup>1</sup> in having the dorsal and anal fins largely covered by scales. A comparison of the type with an Indian example of

<sup>1</sup> Klunzinger—Fische Roth. Meer. i., 1884, p. 131, pl. x., fig. 3.

*M. phaeiceps*, Cuv. & Val. (Day's Collection) which species has been united with *M. lute* by Klunzinger, shows that it has a much smaller and narrower head; it is shorter instead of longer than one-fourth of the length to the hypural, and the interocular space is less instead of more than twice the ocular diameter. *M. tadopsis* is very similar to *M. persia*, Buchanan, with small specimens of which I have compared it, but it has larger scales, there being 30 instead of 35 to the hypural joint and their surface sculpture is less developed than in the Indian species.

*Localities*.—Moreton Bay, Queensland; Type of *M. tadopsis*.

Burdekin River estuary, Queensland; Coll. A. Morton, 1883.

Endeavour River estuary, Queensland; Coll. A. R. McCulloch, 1918.

#### MUGIL GEORGI, *Ogilby*.

(Plate xxii, fig. 1).

*Mugil georgii*, Ogilby, Proc. Linn. Soc. N.S.Wales, xxii., 1897, p. 77. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 22. *Id.*, Stead, Ed. Fish. N.S.Wales, 1908, p. 43. *Id.*, Cockerell, Mem. Qld. Mus., ii., 1913, p. 53.

*Mugil nortoni*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 22.

D. iv, i/8; A. iii, 9; P. 15; V. i, 5; C. 14. 31-32 scales between the operculum and the hypural joint, and 12 between the back and the belly before the first dorsal fin exclusive of the medium dorsal and ventral rows.

Depth before the first dorsal fin 3.4 in the length to the hypural joint: head 4 in the same. Eye 3.7 in the head, equal to its distance from the premaxillary symphysis, and 1.4 in the interorbital space, which is 2.8 in the head. Least depth of the caudal peduncle 1.9 in the head. First dorsal spine 1.9, second dorsal ray 1.7, and pectoral fin 1.1 in the head.

Upper and lower profiles of the head and body almost equally arched. Head deeper than broad. Snout rounded in the horizontal plane, its upper profile convex. Upper lip rather broad and vertical; a few very fine ciliae on the premaxillaries. Mandible very thin, without teeth, its rami meeting at an obtuse angle. Maxilla small, not quite reaching the vertical of the anterior orbital border, and completely hidden beneath the preorbital when the mouth is closed. Preorbital notched and denticulated on its anterior and posterior margins; its upper surface with a few scales. Adipose eyelids well developed but not encroaching upon the pupil. Cheek-scales finely ctenoid, arranged in five rows below the eye; small scales extend over the snout and mandible, and become larger and ciliated on the operculum.

Body scales obscurely ciliated, almost cycloid, but ctenoid on the breast. They are without membranous borders and are largest on the middle of the sides. Axillary scales well developed, reaching along one-third the length of the pectoral; the exobasal scales of the ventrals and spinous dorsal are also conspicuous. The bases of the pectoral and caudal fins are completely covered by scales which also extend up between the rays; a scaly sheath covers the base of the anal; and scales extend up between both the dorsal and anal rays but do not conceal them.

First dorsal spine inserted above the twelfth body-scale, and much nearer the hypural joint than the end of the snout; its first spine is a little longer than the second, but not quite so long as the second dorsal ray, and reaches half its distance from the base of the fourth dorsal ray. Soft dorsal originating over the twenty-second or twenty-third body-scale, emarginate; the space between the origins of the two dorsals equals the length of the head. Anal originating below the twentieth body-scale and terminating below the middle of the dorsal; its base is shorter than its distance from the hypural joint, and its margin is excavate. Pectoral fin reaching the tenth scale but not attaining the vertical of the dorsal origin. Ventrals inserted just behind the vertical of the middle of the pectoral and nearer the anal fin than the end of the snout; it reaches backward to below the middle of the first dorsal. Caudal fin emarginate, the lobes pointed.

Bleached after long preservation. A dark spot at the base of the pectoral, and the margin of the caudal fin blackish.

Described from the holotype of the species, 180 mm. long to the end of the middle caudal rays, which was presented to the Australian Museum by Mr. J. Douglas Ogilby. The accompanying figure represents a larger specimen 231 mm. long, from Port Hacking, in which the pectoral and ventral fins do not reach quite so far back as in the smaller holotype, and the anal is placed rather farther back in relation to the second dorsal.

*Synonymy*.—According to Mr. H. A. Longman, no specimen now in the Queensland Museum can be definitely identified as the type of *M. nortoni*, Ogilby, but an example 165 mm. long, which was incorrectly registered as *M. sterensi* by Ogilby, agrees sufficiently well with the description of *M. nortoni* to leave no doubt as to its identity with that species. I have been enabled to compare this with the holotype of *M. georgii* in the Australian Museum, and can find no characters to separate the two as distinct species.

*Localities*.—Georges River estuary, Botany Bay, New South Wales; Holotype, coll. J. Douglas Ogilby, December, 1895.

Port Hacking, New South Wales; several specimens, presented by the Fisheries Branch, Chief Secretary's Department.

Karnah River estuary, Port Stephens, New South Wales; presented by the Fisheries Branch, Chief Secretary's Department.

Brisbane River estuary, Queensland; (cotype of *M. nortoni*?) Queensland Museum.

#### MUGIL LONGIMANUS, Günther.

*Mugil longimanus*, Günther, Brit. Mus. Cat. Fish., iii., 1861, p. 428. *Id.*, Steindachner, Denk. Akad. Wiss. Wien, xli. i., 1879, p. 5. *Id.*, Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx. i., 1879, p. 395. *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, ix., 1884, p. 41. *Id.*, De Vis, Proc. Linn. Soc. N.S.Wales, ix., 1885, p. 870. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 41. *Id.*, Kent, Gt. Barrier Reef, 1893, pp. 294, 370. *Id.*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 26.



*Mugil cunnesius*, Day, Fish India, 1876, p. 349, pl. lxxiv., fig. 3. *Id.*, Waite, Mem. N.S.Wales Nat. Club, No. 2, 1904, p. 22 (Perhaps not *M. cunnesius*, Cuvier & Valenciennes).

*Characters*.—A specimen in the Australian Museum, 156 mm. long to the end of the middle caudal rays, from Bombay (Dr. Francis Day's Collection), agrees well with that author's figure quoted above. It differs from *Mugil georgii* in several striking characters: the first dorsal spine is inserted nearer the end of the snout than the hypural joint, the cheek-scales are cycloid instead of ctenoid, each body-scale has a membranous border, and the soft dorsal and anal fins are largely covered by scales. A second specimen from the Philippine Islands exhibits the same characters.

*Australian Localities*.—The only definite records of this species from Australian waters are those of Steindachner and Klnnzinger, who recorded specimens from Cleveland Bay, Queensland. In recording Steindachner's reference, O'Shaughnessy, Zoological Record 1879, p. 14, unfortunately gave the locality as Port Jackson, which caused Ogilby to include the species in a List of Fishes of New South Wales. Waite later followed Ogilby, but accepting the synonymy quoted by Day, changed the name from *longimanus* to *cunnesius*. Ogilby has since endeavoured to prove that *longimanus* is not certainly known from Australian waters, and that Steindachner's and Klnnzinger's specimens are identical with *M. nortoni* (= *M. georgii*), but no valid reason is apparent to support this supposition.

#### MUGIL, LIZA, ARGENTEUS, Quoy & Gaimard.

##### Flat-tailed Mullet.

*Mugil argentus*, Quoy & Gaimard, Voy. Uranie, 1825, p. 338, pl. lix., fig. 3.

*Mugil peronii*, Cuvier & Valenciennes, Hist. Nat. Poiss., xi., 1836, p. 138.

*Mugil ferrandi*, Cuvier & Valenciennes, *Tom. cit.*, p. 142—substitute name for *M. argentus*.

*Synonymy*.—Günther<sup>2</sup> included *M. argentus* in a section of the genus *Mugil* which is characterised by the possession of a well-developed adipose eyelid and only nine anal rays, whereas neither the original description nor the figure of the species indicated any such eyelid, and ten anal rays were definitely described. Günther's error has been followed by subsequent authors, and a tropical fish very different to that taken in Port Jackson by Quoy and Gaimard, has been associated with the name *argentus*. Quoy and Gaimard's description and figure were apparently based upon a young example of the common Flat-tailed Mullet, *Mugil peronii*, which name must give place to the earlier *argentus*.

Ogilby<sup>3</sup> has united *Mugil crenidens*, Kner<sup>4</sup> with *M. peronii*, but this is apparently incorrect. Kner described and figured nine anal rays instead of ten as in *M. peronii*, and 43-44 scales instead of 35-38. Kner's species is apparently synonymous with *Myxus elongatus*, Günther.

<sup>2</sup> Günther—Brit. Mus. Cat. Fish., iii., 1861, p. 424.

<sup>3</sup> Ogilby—Proc. Linn. Soc. N.S.Wales, xxii., 1897, p. 79.

<sup>4</sup> Kner—Novara Zool. i., 1865, p. 229, pl. ix., fig. 4.

MYXUS, *Günther*.MYXUS ELONGATUS, *Günther*.

*Myxus elongatus*, Günther, Brit. Mus. Cat. Fish., iii., 1861, p. 466. *Id.*,  
Waite, Tr. Roy. Soc. S. Austr., xl., 1916, p. 454, pl. xlv.

*Maqil crenidens*, Kner, Novara Zool., i., 1865, p. 229, pl. ix, fig. 4.

*Myxus crenidens*, Steindachner, Sitzb. Akad. Wiss. Wien, liii., 1866, p. 461.

*Cæstrus norfolcensis*, Ogilby, Proc. Linn. Soc. N.S. Wales, xxii., 1897, p. 80.

*Synonymy*.—Steindachner has shown that *Maqil crenidens* is a species of *Myxus*, and I find nothing to distinguish it from *Myxus elongatus*. The identity of *Cæstrus norfolcensis* and *M. elongatus* has already been published by Waite.

## Family APOGONIDÆ.

Genus ADEXAPOGON, *Gen. nov.*

First dorsal with six spines, anal with two; soft dorsal and anal each with about ten rays. Preopercular margin and inframarginal crest entire. Scales cycloid; lateral line complete, extending over about 26 scales. A band of villiform teeth in each jaw, without canines, and some minute teeth on the vomer; palatines with or without teeth. Gill-rakers slender and numerous, about twelve on the lower limb of the first gill-arch. Caudal emarginate, its peduncle shorter than the head. A silvery canal extends backwards on each side from the tongue to the caudal peduncle near the ventral surface. Otherwise as in *Apogon*.

*Genotype*.—*Apogon roseigaster*, Ramsay & Ogilby.

*Affinities*.—This genus differs from *Siphonina*, Weber<sup>5</sup>, in which a similar silvery canal is developed, in having cycloid instead of ctenoid scales; its preopercular margin also is smooth instead of serrated. In these characters it agrees with *Rhabdamia*, Weber<sup>6</sup>, but the silvery organ is wanting in that genus.

Weber has suggested (*Tom. cit.*, p. 244) that the silvery canal extending along each side of the body behind the anal fin in various Apogonids is an invagination of the peritoneum, which perhaps serves as a hydrostatic apparatus to enable deeper water species to ascend to shallower depths. In *A. roseigaster* and *A. woodi*, both of which occur in shallow water, this canal appears to have no connection with the body-cavity, but is continued forward to a thick gland which is situated at the base of the tongue, and appears to be a phosphorescent organ.

<sup>5</sup> Weber—Siboga Exped., lvi., 1913, p. 243.

<sup>6</sup> Weber—*Tom. cit.*, p. 240.

ADENAPOGON ROSEGASTER, *Ramsay & Ogilby*.

(Plate xxi, fig. 2).

*Apogon roseigaster*, Ramsay & Ogilby, Proc. Linn. Soc. N.S.Wales (2), i., 1886, p. 1101. *Id.*, Ogilby, Proc. Roy. Soc. Qld., xxi., 1908, p. 24.  
*Amia roseigaster*, Stead, Proc. Linn. Soc. N.S.Wales, xxx., 1905, p. 481.

Br. 7; D. vi, i/10 (11); A. ii/10 (11); P. 14; V. i/5; C. 17. L. lat. 26; l. tr. 1, 1, 5.

Depth 2.9 in the length to the hypural joint; head 2.6 in the same. Diameter of the eye 3.8 in the head, longer than the snout, and a little greater than the interorbital width; snout 4.7, interorbital space 4 in the head. Second dorsal ray 1.9 in the head, and a little longer than that of the anal; caudal peduncle 1.6 in the head.

Snout obtuse, the jaws subequal. Nostrils large, with a short interspace between them; the anterior with a low membranous border. Maxilla broad, naked, its hinder angle reaching beyond the vertical of the middle of the eye. Both the preopercular margin and the inframarginal crest are entire; opercular border membranous, without spines. A narrow band of villiform teeth in each jaw; vomer with a few microscopic teeth or smooth, palatines and tongue smooth. Gill-rakers slender, fourteen on the first gill-arch, those at the hinder angle about half as long as the eye.

A thick silvery gland with a black upper surface is situated on each side of the base of the tongue, from which a broad silver canal extends backward on each side of the isthmus to the breast; it expands over the base of the pectoral and covers the lower portion of the abdomen, and thence runs backward above the base of the anal fin to a short distance before the hypural joint. It is sharply defined, largely by a blackish line, and is perhaps an elaborate phosphorescent organ.

Head largely covered by membrane which is permeated by canals and pores; it extends backward on the neck to the fourth scale before the dorsal fin. Operculum with about five large cycloid scales. Body-scales cycloid; they extend over the base of the caudal fin, but the other fins are naked. Lateral line parallel with the back, and extending onto the base of the caudal fin.

First dorsal fin rounded, the third spine longest. Second ray of soft dorsal highest and much longer than the third dorsal spine; the edge of the fin is slightly emarginate. Anal has its origin and termination a little behind the same points of the second dorsal, but is similar to that fin in form. Pectorals rounded, the fourth ray longest and reaching the vertical of the anal origin. Ventrals inserted in advance of the pectorals, and not nearly reaching the vent. Caudal emarginate.

Colouration almost uniform after preservation; a few brown spots on the head form a bar across the snout and a less definite one across the cheek. Each dorsal fin with a broad brown band crossing its lower half; a similar band may be present on the anal.

Described and figured from a specimen 62 mm. long to the end of the middle caudal rays, from the Clarence River estuary, which is well

preserved though it has lost all its scales. These are preserved in a smaller example from the Parramatta River estuary, which was collected by Mr. J. Douglas Ogilby in 1886, and has served to complete the description and figure.

*Habits*.—Ogilby recorded that this species was plentiful in the Parramatta River estuary, numbers being obtainable any morning in the fish market among prawns from that locality. It is also commonly secured by net fishermen on the *zostera* flats around Port Jackson. Stead recorded that the species, like many others of the family, carries its eggs in the month until they hatch. A specimen in the Australian Museum has the mouth crammed with eggs, each of which is as large as the pupil of the eye, and many others are hanging outside the jaws.

*Localities*.—A number of specimens are in the Australian Museum from Port Jackson, and two from the Clarence River estuary. Ogilby has recorded the species from the estuary of the Brisbane River, Queensland, where it is abundant.

ADENAPOGON WOODI, *sp. nov.*

(Plate xxi., fig. 3).

Br. 7; D. vi, 1/8; A. ii/8; P. 12; V. 1, 5; C. 17. L. lat. about 25.

Depth 3.8 in the length to the hypural joint; head 2.7 in the same. Diameter of the eye 3.5 in the head, longer than the snout, and a little greater than the interorbital width; snout 4.6, interorbital space 3.7 in the head. Second dorsal ray 2.2 in the head and a little longer than that of the anal; caudal peduncle 1.4 in the head.

Snout conical, the lower jaw projecting. Nostrils large, separated by a narrow interspace; the anterior with a low membranous border. Hinder angle of the maxilla somewhat produced, reaching the vertical of the middle of the eye. Both the preopercular margin and the infra-marginal crest are entire; operculum membranous, its spines rudimentary. A narrow band of villiform teeth in each jaw, and microscopic teeth are present on the vomer and palatines; tongue smooth. Gill-rakers slender, fourteen on the lower limb of the first arch; those at the hinder angle are about half as long as the eye. A thick silvery gland on each side of the base of the tongue, from which a silver band extends backward to near the hypural joint as in *A. roseigaster*.

Head largely covered by a membrane which extends backward onto the neck, and is permeated by canals and pores. A single scale at the origin of the lateral line is cycloid; all the others are missing, but the scale-pits indicate that there were about 25 on the lateral line.

First dorsal rounded, the third spine longest. Second dorsal rounded, the second ray longest, and much longer than the third spine; most of the rays are bifurcate. Anal rounded, its origin and termination behind the same points of the second dorsal. Pectoral very small, rounded, the fourth ray longest but not nearly reaching the vertical of the vent. Ventrals inserted in advance of the pectorals and not quite reaching the vent when adpressed. Caudal emarginate.

*Colour*.—Brown in alcohol, profusely speckled with dark dots which form darker patches at the bases of all the vertical fins; they also form an oblique bar across the cheek, and one before the eye. The silver band is dotted with black and is sharply defined by blackish borders. Eyes, cheeks, lower portion of operculum, and sides of abdomen silvery. Fins with a few scattered dark dots.

Described and figured from a specimen 44 mm. long to the end of the middle caudal rays.

*Affinities*.—The differences between this species and *A. roseigaster* are expressed in the following key.

- a.* Depth greater than one-third of the length; palatines toothless;  
pectoral reaching the vertical of the anal origin; dorsal and  
anal fins each with ten rays, their margins subtruncate ..... *roseigaster*.
- aa.* Depth less than one-third of the length; palatines with teeth;  
pectoral not nearly reaching the vertical of the vent;  
dorsal and anal fins each with eight rays, their margins  
rounded ..... *woodi*.

That *A. woodi* is not the young form of *A. roseigaster* is proved by the fact that I have several specimens of the latter which are much smaller than some of my examples of *A. woodi*, and exhibit the distinguishing characters noted above. Neither is it a sexual form, since a series of numerous specimens of *A. woodi* include examples with both milts and roes.

*Breeding*.—Several males about 40 mm. long, have their mouths filled with a number of large eggs in more or less advanced stages of development. Some females have the body-cavity greatly distended with a large number of eggs ready for extrusion, each of which is about as large as the pupil of the eye.

This species is named after Mr. A. W. Wood, officer in charge of the Fisheries Branch, Chief Secretary's Department, through whose interest a large collection was transferred from his department to the Australian Museum. It included a fine series of this interesting species.

*Localities*.—Over fifty examples, 37-49 mm. long, are in the Australian Museum from Rose Bay, Port Jackson, and Port Hacking, New South Wales, which were collected by Mr. David G. Stead. A single specimen from Queenscliff, Victoria, was collected by Mr. Edgar R. Waite.

### Family LABRIDÆ.

#### Genus PSEUDOLABRUS, *Bleeker*.

A fine series of specimens collected in New Zealand by Mr. Charles Hedley, enables me to supplement my earlier notes<sup>7</sup> upon several species which have been recorded from Australian waters.

<sup>7</sup> McCulloch—Rec. Austr. Mus., ix., 3, 1913, p. 361.

PSEUDOLABRUS CELIDOTUS, *Forster*.

*Pseudolabrus celidotus* (Forster) McCulloch, Rec. Austr. Mus., ix, 3, 1913, p. 375.—Synonymy and references.

Nine well preserved specimens, 175-255 mm. long, are separable into the two forms *celidotus* and *bothryocosmus* as figured by Richardson<sup>8</sup>. Four are referable to *celidotus* and five to *bothryocosmus*, but one of the latter has the characteristic lateral blotch of *celidotus* faintly indicated in addition to its own colour-markings. Since all the specimens were taken at the one locality, I follow Waite<sup>9</sup> in regarding them as variations of the one species.

The two forms exhibit the following distinctive colour-marking.—

- A large dark blotch on and below the lateral line behind the pectoral fin. Upper surface of the head usually spotted; a dark stripe passes from the middle of the preorbital to the eye, behind which are two lines extending backwards. Soft dorsal usually with oblique series of dark stripes and spots, which may expand into larger irregular spots. Anal with dark spots, and an indefinite medium stripe ..... *celidotus*.
- Several scales between the lateral line and the middle of the back with irregular blackish spots. Upper surface of the head plain; a sinuous stripe passes from the lower part of the preorbital towards and under the eye. Soft dorsal usually with a more or less distinct darker horizontal stripe; a dark median stripe along the anal ..... *bothryocosmus*.

Loc.—Portobello, Port Chalmers, New Zealand; 7th-13th December, 1918. In the seine and by hook and line.

PSEUDOLABRUS MILES, *Bloch & Schneider*.

*Labrus miles*, Bloch & Schneider, Syst. Ichth., 1801, p. 264, and *L. coccineus*, Forster, MS.

*Julis? rubiginosus*, Richardson, Ann. Mag. Nat. Hist., xi., 1843, p. 425.

*Labrichthys psittaculus*, Hutton, Cat. Fish. N.Zeal., 1872, p. 43, and Tr. N.Z. Inst., v., 1873, p. 265, pl. x., fig. 69, and *Loc. Cit.*, ix., 1877, p. 354. (Not of Richardson).

*Labrichthys rosipunctatus*, Hutton, Tr. N.Z. Inst., xii., 1880, p. 455.

*Pseudolabrus coccineus*, Waite, Rec. Canth. Mus. i. 3, 1911, p. 224, pl. xlvii.

Three specimens 220-290 mm. long, exhibit the characters described and figured by Waite. Their pink colouration is, however, much more delicate than the somewhat unfinished illustration indicates.

Loc.—Secured by line fishing off Cape Saunders, near Port Chalmers, New Zealand; 17th Dec., 1918.

<sup>8</sup> Richardson—Ichth. "Erebus & Terror," i., 3, p. 53, pl. xxxi.

<sup>9</sup> Waite—Rec. Canth. Mus., i., 3, 1911, p. 224.

PSEUDOLABRUS PSITTACULUS, *Richardson*.

*Labrus psittaculus*, Richardson, Proc. Zool. Soc., 1840, p. 26, and Trans. Zool. Soc., iii., 1849, p. 141. *Id.*, Richardson, Ichth. "Erebus & Terror," 1848, p. 129, pl. lvi., fig. 7-10.

*Labrichthys psittaculus*, Günther, Brit. Mus. Cat. Fish., iv., 1862, p. 114; *Id.*, Castelnau, Proc. Zool. Soc. Viet., ii., 1873, p. 52; *Id.*, Macleay, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 79; *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 124, and *Loc. Cit.*, 1890 (1891), p. 35; *Id.*, Lucas, Proc. Roy. Soc. Viet. (2), ii., 1890, p. 32.

*Labrichthys rubicunda*, Macleay, Proc. Linn. Soc. N.S.Wales, vi., 1881, p. 89.

*Labrichthys mortoni*, Johnson, Proc. Roy. Soc. Tasm., 1884 (1885), p. 256.

*Pseudolabrus psittaculus*, McCulloch, Zool., Res. Endeavour, i. 1, 1911, p. 77, fig. 19.

*Pseudolabrus miles*, McCulloch, Rec. Austr. Mus., ix., 3, 1913, p. 372. (Not of Bloch & Schneider).

This species is quite distinct from *P. miles*, Bloch & Schneider, with which it has been confused. It has only three or four series of cheek-scales instead of about six, which become uniserial instead of biserial behind the eye. Comparing examples of both species of similar size, the eye of *P. psittaculus* is seen to be smaller in relation to both the inter-orbital space and the length of the snout. *P. miles* has a broad brownish-violet band across the base of the tail which is wanting in *P. psittaculus*, and the outer borders of that fin are darker instead of uniform with the rest. *P. psittaculus* has often some dark spots at the base of the posterior dorsal rays and on the caudal peduncle which are wanting in *P. miles*.

*P. psittaculus* is known from southern Australia and Tasmania. Hutton's identifications of the species from New Zealand evidently refer to *P. miles*. (See *ante*).

## Family ISTIOPHORIDÆ.

Genus ISTIOPHORUS, *Lacepède*.ISTIOPHORUS GLADIUS, *Broussonet*.

## Sail Fish.

(Plate xxiv., fig. 1).

*Scomber gladius*, Broussonet, Mem. Acad. Sci., 1786, p. 454, pl. x.

*Istiophorus gladiifer*, Lacepède, Hist. Nat. Poiss., iii., 1802, p. 374.

*Istiophorus indicus*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii., 1831, p. 293, pl. cccxix. *Id.*, Valenciennes, Regne Anim. Illustr. Poiss., 1836-49, p. 124, pl. liii., fig. 1.

*Histiophorus gladius*, Günther, Brit. Mus. Cat. Fish., ii., 1860, p. 513. *Id.*, Day, Fish, India, pt. 2, 1876, p. 198. *Id.*, Castelnau, Proc. Linn. Soc., N.S.Wales, iii, 1879, p. 352. *Id.*, Macleay, Proc. Linn. Soc., N.S.Wales, v., 1881, p. 522. *Id.*, Goode, Rept. U.S. Fish Comm., 1880 (1883), p. 309, pl. viii. *Id.*, Ogilby, Cat. Fish. N.S.Wales, 1886, p. 25.

*Istiophorus gladius*, Stead, Proc. Linn. Soc. N.S.Wales, xxxvi., 1911, p. 44.

D. 46/7; A. 12/6; P. 18; V. i/2. Branchiostegals 7.

Depth at the base of the anterior dorsal rays and excluding the dorsal sheath 1·7 in the length of the head from the tip of the mandible to the opercular margin, and about 7·7 in the length from the end of the mandible to that of the middle caudal rays; depth before the anterior anal fin 2·4, and of the caudal peduncle 6·4 in the head measured as above. Eye 9·7 in the head and 1·7 in the interorbital width, which is 5·5 in the head. Rostrum (incomplete) 2·1 as long as the rest of the head. Pectoral 1·3 in the head. Highest dorsal rays subequal in length to the head from the end of the rostrum to the opercular margin.

Rostrum straight, subcylindrical distally, though a little broader than deep; its upper surface is smooth, but the sides and lower surface are covered anteriorly with spinules which extend backward on each side in a gradually narrowing row to below the middle of the eye. Maxilla a thin and rather narrow plate which is obtusely pointed posteriorly, and reaches backward beyond the posterior margin of the eye. Mandible pointed, the symphysis forming a subcylindrical bone like the rostrum; its upper surface is covered with similar spinules which extend backward on the sides to below the anterior portion of the eye. No teeth on the palate, but minute spinules are present on the soft membrane between the symphysis of each jaw. Nostrils small and close together, situated a little before the upper portion of the eye, and separated by a small rounded lobe. Preopercular edge thin and almost entire, the angle somewhat rounded. Operculum, unarmed, with a rounded membranous edge. Gill-membranes free and broadly united across the isthmus. Gill-arches smooth, without gill-rakers. Four gills, a slit behind the fourth: pseudobranchiae well developed.

Body slender and compressed, broadest anteriorly and becoming gradually narrower backwards. A broad fleshy fold on each side of the back forms a sheath to accommodate the anterior dorsal fin, and similar folds along the ventral edge as far as the vent form a sheath for the ventral rays; the anterior anal fin is also provided with a sheath, but the bases of the second dorsal and anal are uncovered. The entire surface of the body is beset with elongated pointed scales which are shortest and broadest on the dorsal surface but become very long and slender on the abdominal region. Lateral line elevated into a low peak above the base of the pectoral fin, after which it quickly descends to the middle of the body and extends backward in a straight line to the tail. Caudal peduncle deeper than broad; two small keels on each side of the base of the tail which converge slightly backwards.



First dorsal fin commencing a little behind the vertical of the preopercular margin, and formed of flexible rays united by a leathery membrane. Its first three rays are short though increasing in length successively; the fourth forms the anterior margin of the fin and is longer than the five following it; thence the rays increase more or less regularly in length to the twenty-second, which is the longest of all; after this they decrease again, and form a rounded though somewhat uneven margin to the fin: the fifth to the eleventh rays and the fifteenth are bifurcate, but all the others are simple. A short space separates the two dorsals. Second dorsal formed of branch rays; the first is longer than those following it, but shorter than the last which is prolonged and thickened. Second anal similar to and opposite the second dorsal. Third ray of the anterior anal longest and simple, and inserted nearer the base of the tail than that of the pectoral fin; it is followed by several branched rays, after which the others are simple. Pectoral falcate, the upper ray longest and broader than the others. Ventrals broken; each is formed of one spine and two flattened rays, all closely in contact. Caudal greatly forked, with a thick muscular base which largely covers the median rays.

*Colour-marking.*—The specimen has become greatly stained during preservation but the upper portion appears to have been uniformly dark coloured and the lower lighter. The anterior dorsal fin is uniformly black.

Described and figured from a specimen about 6 feet 8½ inches long over all. It has been cut into three sections and the end of the rostrum is broken off, so that its exact length cannot be determined, but it measures approximately 1570 mm. from the end of the lower jaw to the tips of the middle caudal rays.

*Locality.*—This specimen has been presented to the Trustees of the Australian Museum by the Fisheries Branch, Chief Secretary's Department. It is unfortunately without data, but Mr. Stead informs me that it is the example recorded by him (*Loc. cit.*), from Port Stephens. A dorsal fin which was supposed to have been taken in New South Wales waters by Dr. Bennett was identified as belonging to *I. gladius* by Günther.

### FAMILY GEMPYLLIDÆ.

Genus THYRSITES, *Cuvier*.

THYRSITES *atun*, *Euphrasen*.

(Plate xxiv., fig. 2).

Barraconta.

*Thyrsites atun* (Euphrasen) Cuvier & Valenciennes, Hist. Nat. Poiss., viii., 1831, p. 196, pl. ccxix. *Id.*, Günther, Brit. Mus. Cat. Fish., ii., 1860, pp. 350, 527.

D. xx/12/5; A. 12/6; P. 14; V. i/5; C. 17. Depth before the ventral fins 7·6 in the length to the hypural joint; head 4·02 in the same. Eye 1·2 in the interorbital space, 2·7 in the snout, and 6·5 in the head; interorbital width 5·2, and snout 2·3 in the head. Fifth dorsal spine 3·0, third dorsal ray 3·2, and pectoral fin 2·2 in the head; length of the ventral fins subequal to the interorbital width.

Body elongate and strongly compressed. Upper profile of the head forming an oblique line from the snout to the origin of the dorsal fin. Premaxillary symphysis pointed, the mandible projecting well beyond it; interorbital space flat. Maxilla reaching a little beyond the vertical of the anterior ocular margin; its hinder margin is rounded, and there is an oblique groove behind it. Nostrils widely separated, situated in a shallow depression on the side of the snout. Preopercular border membranous, only the rounded angle and the lower edge free. Opercular bones thin and unarmed; a deep incision in the opercular edge is covered with membrane.

Each premaxillary with a single row of compressed teeth which are smallest anteriorly; mandibles with similar but larger and widely spaced teeth. Three large compressed teeth at the symphysis of the upper jaw, and one very small tooth on each side of the vomer; a row of small teeth on each palatine.

Entire body covered with small and very thin cycloid scales which are very deciduous. They are also present on the head, commencing above and between the nostrils, and extending to the edges of all the opercles. Minute scales are also present on the maxilla, but the snout and mandible are naked. Indications of minute scales remain on the anterior rays and base of the soft dorsal, and on the greater part of the caudal fin. Lateral line commencing above the operculum, and running parallel with the back to below the fifteenth dorsal spine; thence it curves sharply downward to the middle of the body, along which it makes a sinuous course to the hypural joint.

Dorsal fin originating a little before the vertical of the opercular edge; the spines increase slightly in length to the fifth, after which they decrease regularly to the last; a short interspace separates the spinous and soft dorsals. Third dorsal ray but little shorter than the fifth spine, and not quite reaching the base of the last when adpressed. Anal fin originating a little behind the vertical of the first dorsal ray; its third ray is as long as that of the dorsal, and is equal to the basal length of the fin. Pectoral pointed, the third upper ray longest. Ventral small, inserted well behind the base of the pectoral; the last ray is united with the abdomen by membrane. Caudal deeply forked.

*Colour*.—Steel blue on the back, brilliant silver on the sides and lower surface. Membrane of spinous dorsal largely black, the spines and basal parts white. Soft dorsal and pectoral margins blackish. Eye pale golden.

Described and figured from a specimen 450 mm. long to the end of the middle caudal rays, which was captured near Sydney, and presented to the Australian Museum by Mr. A. W. Wood, officer in charge of the Fisheries Branch, Chief Secretary's Department.

*Variation*.—A small example, 176 mm. long to the end of the middle caudal rays, is very similar to the specimen described, differing only in some of its proportions. The depth is 8.1 in the length to the hypural joint, and the head is 3.7 in the same. The eye is 5.5 in the head, and is wider than the interorbital space. It has six dorsal finlets, which number is more usual than five as described above.

*Distribution*.—*T. atun* was originally described from South Africa, and is also recorded from South America. It is plentiful in New Zealand, Tasmania, and Victoria, and ranges northward on the coast of New South Wales to beyond Port Jackson. It also occurs in South Australia, but has not yet been recorded from the West.

#### Family OGCOCEPHALIDÆ.

Genus HALIEUTAEA, *Cuvier & Valenciennes*.

HALIEUTAEA BREVICAUDA, *Ogilby*.

*Halieutaea brevicauda*, *Ogilby*, New Fish. Qld. Coast, 1911, p. 138. *Id.*, *McCulloch*, Biol. Res. Endeavour, ii. 3, 1914, p. 163, pl. xxxiii.

*Variation*.—Three specimens 111, 133, and 147 mm. long differ from the holotype of the species, which is only 106 mm. long, in several details. Though the larger spines on the back and lateral margins are similarly arranged in all, the smaller spines are rather less numerous than in the holotype, and are almost wanting in the median sized specimen. The microscopic spinules covering the ventral surface are not very evident in the smallest specimen, but they are easily detected everywhere in the largest example. Two specimens agree with the holotype in having only four dorsal rays, but the other has five. The pectorals of the holotype have each a darker cross-band which is replaced by a broad marginal band in one specimen and is wanting in the others; the posterior portion of the caudal fin is dark grey; the back is ornamented with greyish-brown dots which form two irregular, but symmetrically placed, elongate rings, one of which extends down each side of the back and the other from the eye to the base of the pectoral.

These three specimens are so very similar, however, that I regard the above differences as mere individual variations.

*Localities*.—Off Cape Moreton, Queensland; 73 fathoms. Holotype.

Off Wata Mooli, New South Wales; 68 fathoms.

Off Bay of Fires, Tasmania; 45 fathoms.

#### Family DIODONTIDÆ.

Genus ALLOMYCTERUS, *gen. nov.*

Near *Dicotylichthys*, having a bifid nasal tentacle without openings, but all the spines are three-rooted and fixed. The greater part of the forehead is naked, and the dorsal and anal fins have each about sixteen rays. The bifid nasal tentacle and increased number of dorsal and anal rays distinguishes this genus from *Chilomycterus*.

*Type*.—*Diodon jaculiferus*, *Cuvier*.

ALLOMYCTERUS JACULIFERUS, *Cuvier*.

(Plate xxxiii., fig. 2).

*Diodon jaculiferus*, *Cuvier*, Mem. Mus. Hist. Nat., iv., 1818, p. 130, pl. vii. *Id.*, *Kaup*, Arch. Naturg., xxi. i., 1855, p. 229.

*Chilomycterus jaculiferus*, *Günther*, Brit. Mus. Cat. Fish., viii., 1870, p. 313. *Id.*, *Hutton*, Cat. Fish. N.Zeal., 1872, p. 73, and Trans. N.Zeal. Inst., v., 1873, p. 271. *Id.*, *Castelnau*, Proc. Zool. Soc. Viet., i., 1872, p. 211. *Id.*, *Macleay*, Proc. Linn. Soc. N.S.Wales, vi., 1881,

p. 345. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 136, and 1890 (1891), p. 38. *Id.*, Lucas, Proc. Roy. Soc. Vict. (2), ii., 1890, p. 42. *Id.*, Waite, Mem. Austr. Mus., iv., 1, 1899, p. 98. *Id.*, Woodward, W. Austr. Year-book, 1900-1 (1902), p. 272.

*Dicotylichthys jocaliferus*, Waite, Mem. N.S. Wales Nat. Club, No. 2, 1904, p. 58, and Rec. Canb. Mus., i., 1907, p. 34.

D. 16; A. 16; P. 20; C. 9. Length of the head to the gill-opening 3.0 in the length to the hypural joint. Length of the eye a little greater than the width of the gill opening, 4 in the head. Eye 2.4 in the inter-orbital space, which is 1.6 in the head. Highest dorsal rays a little longer than those of the anal, 1.7 in the head.

The snout, chin, and central portion of the interorbital area are naked. A spine is present above the antero-superior angle of each orbit, and one or two near the postero-superior margin; a large one is placed above the middle of each eye which is nearer the orbital margin than the median line of the head. A spinule is present between the eye and the angle of the mouth, and two others may be present under and behind the eye. Five spines form a row between the occiput and the base of the dorsal fin, and a longer one is present on each side of the caudal peduncle just behind the dorsal. An elongate, two-rooted spine behind the pectoral fin is the only movable spine of the body. Abdominal spines smaller than those of the back, and becoming still smaller as they approach the sides of the head.

Eye much shorter than its distance from the premaxillary symphysis. Interorbital space broad and flat. Nasal tentacle consisting of two flat lobes, a little nearer the eye than the end of the snout. Gill opening vertical, almost as wide as the eye.

Dorsal fin large, its anterior margin rounded, the posterior subtruncate, the junction of the two forming an obtuse angle. Anal placed a little farther back than the dorsal, its margin rounded. Hinder margin of pectoral somewhat emarginate unless greatly expanded, the second and third rays a little prolonged. Caudal rounded.

*Colour*.—Back and upper portion of sides olive-grey in life, with large black spots around the bases of some of the spines. An olive and yellow blotch between the eye and the gill-opening. A large black blotch behind the pectoral fin, and the spines surrounding it have bright yellow bases. An indefinite olive and yellow blotch on the middle of the sides below the origin of the dorsal fin. Sides and belly tinged with olive; eye olive.

Described and figured from a specimen 254 mm. long from off Botany Bay, New South Wales, which is similar in all details to the specimen recorded from New South Wales by Waite.

*Distribution and Localities*.—This species is common in Tasmanian waters, according to Johnston, and has been recorded from Victoria by Castelnau. Waite recorded a single specimen from 29-48 fathoms off Broughton Island, New South Wales, and the species is not uncommonly taken by trawlers in similar depths on the coast near Sydney. It has been recorded from Western Australia by Woodward, and I have examined a large dried skin which was obtained at Nornalup Inlet on the south-western coast.

The species is common in New Zealand waters according to Hutton.

## STUDIES IN AUSTRALIAN REPTILES

No. 2.\*

BY

J. R. KINGHORN, Zoologist, Australian Museum.

(Plates xxv.-xxvi., and Figures 1-9).

The following paper deals with specimens contained in the Australian Museum and includes a new variety of *Notechis scutatus*, from Kangaroo Island, South Australia; a re-examination of Krefft's types of *Hoplocephalus ater*, and *Denisonia ornata*; a discussion on the status of *Dendrelaphis schleuckeri*, Ogilby; and the recording of *Pseudechis mortuensis*, De Vis, and *Denisonia maculata* var. *derisi*, Waite and Longman, from north-western New South Wales. Where necessary, re-descriptions and figures have been added.

*NOTECHIS ATER*, Krefft.

(Plate xxv., figs. 5-7).

*Hoplocephalus ater*, Krefft, Proc. Zool. Soc., 1866, p. 370, and Snakes of Australia, 1869, p. 55, pl. xi., fig. 2.

Having examined Krefft's type of *Hoplocephalus ater*, I have no hesitation in reinstating the species, but as *Notechis ater*, under which genus Mr. Boulenger placed it.<sup>1</sup> On comparing the type with the original description and figure, I found that it did not quite agree with either in some of the details of the head shields; furthermore, Krefft's own figure and description do not accord with each other. The colour, as described by Krefft, together with many errors in his description, has led several authors to place this species as a melanotic form of *Notechis scutatus*. As I am fortunate enough to have the type on hand, I am able to extend my examination, for comparative purposes, to a large series of *Notechis scutatus* in the Australian Museum collection, and I find that more than one character, quite apart from the colouration, shows that Krefft's specimen is a very distinct species.

### COMPARATIVE.

*Temporals*.—In *Notechis scutatus* the lower anterior temporal is the largest and it is wedged in between the fifth and sixth upper labials; while in *Notechis ater* the upper posterior temporal is the largest and the lower anterior is wedged in between the fourth and fifth upper labials.

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\* For No. 1, see Rec. Aust. Mus., Vol. xiii., No. 3, 1920, p. 110.

<sup>1</sup> The errors in Krefft's description led Mr. Boulenger to place *H. ater* in the synonymy of *Notechis scutatus*; see Brit. Mus. Cat. Snakes, 1896, iii., p. 351.

*Upper Labials.*—Throughout the Australian Museum series of *Notechis scutatus* there are never less than six upper labials, while an occasional specimen may have seven, and invariably the third and fourth enter the eye. Contrary to this, *Notechis ater* has only five upper labials, and the second and third enter the eye. The first and second of these shields are comparatively larger than the corresponding ones in *N. scutatus*, the first reaching back to the posterior extremity of the nasal. All these shields are very clearly defined on both sides of the head, and there is not the slightest sign of any fusing or abnormality.

*Errors in the original description.*—Krefft states that the anterior frontals are as large again as the posterior ones (he was evidently referring to the internasals and prefrontals), but the latter are twice as large as the former, as his and my figures show, and not the reverse as stated by him in his text. He also stated that there were six upper labials and only one narrow anterior temporal, but he undoubtedly mistook the large, lower anterior temporal for a labial shield, as it actually forms the border of the upper lip for a short distance; this distance, however, is a little greater on the left<sup>2</sup> than on the right side of the head. If this temporal be counted as a labial, there would be six upper labials as in *N. scutatus*, but this would leave only three temporals, one narrow anterior and two posterior, and so under ordinary circumstances it could be counted as an abnormality. In the present case whether it be regarded as a temporal, or a labial, it has not so much bearing upon the relationship of *N. ater* to *N. scutatus*, as have those outstanding characters already referred to, that is, the second and third upper labials enter the eye, and the upper posterior temporal is the largest.

*Re-description from the type.*—Eye longer than high; as long as the nasal, and as high as its distance from the mouth. Pupil round. Rostral broader than deep, the portion visible from above about half as long as its distance from the frontal. Internasals once and one half times as broad as deep at their deepest point, and about half the size of the prefrontals which bend down over the sides of the snout forming an oblique suture with the nasal. Frontal a fraction longer than broad, about twice as broad as the supra-oculars across their centre; it is shorter than the suture formed by the parietals, and a little longer than its distance from the posterior border of the rostral. Parietals nearly twice as long as the frontal. Nasal entire, in contact with the single preocular. Nostril oblique, not reaching to the edges of the nasal shield. Two post oculars; temporals 2+2; of the anterior pair the upper is long and narrow, the lower is the larger and it is wedged in between, and entirely separates the fourth and fifth upper labials, reaching the lip. The upper posterior temporal is the largest. Five upper labials, the second and third entering the eye. Seven lower labials, and the first three are in contact with the anterior chin shield which is as long as the posterior. Scales in 17 rows; ventrals 163; anal single; subcaudals 47, in a single row. Total length 650 mm., of which the tail measures 110 mm.

<sup>2</sup> Side figured.

*Colour*.—As given by Krefft:—"General colour black, chin shields whitish on the outer margin. Beneath, bluish black, clouded with a somewhat lighter tint on the posterior part."

As the specimen appears to-day in spirits, the markings remain unchanged, but the tint of the upper parts has changed to a dark olive green.

Described from a single specimen from Flinders Range, South Australia. Holotype in Australian Museum, Reg. no. 6577.

#### KEY TO THE SPECIES OF *Notechis*.

- (1) 6 upper labials, third and fourth entering the eye.
  - a.* Posterior chin shields largest. Colour above varying shades of brown to olive, with dark cross bars, belly yellowish.....*scutatus*.
  - b.* Chin shields equal in length. Colour black above, belly bluish grey, chin shields and surrounding scales whitish.....*scutatus* var. *niger*.
- (2) 5 upper labials, second and third entering the eye.....*ater*.

#### NOTECHIS SCUTATUS, VAR. NIGER, VAR. NOV.

(Plate xxvi., figs. 6-8).

A large *Notechis scutatus* before me from Kangaroo Island, South Australia, is so distinct in its colouration from the typical form, and from the black specimens from Tasmania referred to by Krefft,<sup>3</sup> that I hold the opinion that it should be provided with a varietal name. In colour it closely resembles *N. ater*, Krefft, but its scaling and lateral head shields at once distinguish it from that species and place it as a variety of *N. scutatus*. I have examined a large series of the latter species in the Australian Museum collection and one of these, a Tasmanian one, is the nearest approach to the specimen before me, its colour being (in spirits) a very dark olive above, while the ventrals are light grey with dark blotches across their edges; the lateral scales here and there show slight traces of the dark cross bands which are representative of the typical form. In this specimen the scales are in very irregular rows, caused by their great variety of shapes and sizes, and they number 15, 16, or 17 at different points, it being most difficult to follow one row completely round the body. The remainder of the series examined, although ranging from a coppery to an olive colour above, show distinct cross bars. The majority have 19 rows of scales round the body, but four have 15 to 17.

The frontal shield varies slightly in length in comparison to its breadth, and may be shorter or longer than its distance from the end of the snout.

<sup>3</sup> Krefft—Snakes of Australia, 1869, p. 53.

I propose calling the variety before me *Notechis scutatus*, var. *niger*, and it may be distinguished from *N. scutatus* not only by its colour but by having the chin shields equal in length, while in the latter species (as shown throughout the series) the posterior are distinctly longer than the anterior.

*Description*.—Eye longer than high, as long as its distance from the mouth, half as long as its distance from the end of the snout. Pupil round. Rostral broader than deep, the portion visible from above about two thirds as long as the suture between the prefrontals. Internasals once and one half as broad as deep, and about half the size of the prefrontals, which bend down over the side of the snout forming oblique sutures with the nasals. Frontal once and one sixth as long as broad, twice as broad as the supraoculars on a line drawn across their centre; it is as long as the suture formed by the junction of the parietals and not quite so long as its distance from the one of the snout. Parietals once and two-thirds as long as the frontal. Nasal entire, angulate, in contact with the single preocular. Nostril large, reaching to the upper and lower edges of the nasal shield. One preocular; two post-oculars; temporals  $2 + 2$ , the lower anterior largest, wedged in between, and almost entirely separating the fifth and sixth upper labials, and in contact with the lower post-ocular. There are several enlarged scales behind the temporals. Six upper labials, the third and fourth entering the eye. Six lower labials; three are in contact with the anterior chin shield which is as long as the posterior. Scales in 19 rows. Ventrals rounded, 184. Subcaudals 45, in a single row. Anal entire. Male. Total length, taken when freshly captured, 1,430 mm., of which the tail is 162 mm.

*Colour*.—From life. Head black. Back dark steel blue (in spirit, black), most of the scales of the anterior portion being distinctly tinged with brown along their free edges and at their bases. Ventral shields shiny dark-blue grey (in spirit the anterior ones have the effect of being marbled) and in some lights and angles show a brown tinge. Several of the scales posterior to the chin shields on either side are white, while the next five or six which border the ventrals along either side of the neck are whitish on their outer edge. There is a white line across the lowest visible portion of the rostral.

*Locality*.—Deep Creek, 20 miles from Kingscote, Kangaroo Island, South Australia.

Described from a single specimen which was collected by Mr. E. le G. Troughton, of the Australian Museum staff, and by whom the colour notes as above were made on the spot.

*Habits*.—The inhabitants of the island evidently being under the impression that this species was a variety of the black snake (*Pseudechis porphyriacus*), described it as being more sluggish than the mainland type, and having a dull coloured belly. Mr. Troughton found this specimen to be anything but sluggish; he shot it while it was attempting to drag away a rat which was caught in a trap, and which was already dead. It was shaking the rat and trap violently, and when disturbed, began to



move off tail foremost, dragging them after it. When being carried back to camp it was observed to flatten and distend about four inches of its neck, immediately behind the head. When opened for examination the stomach and bowels were found to be empty.

Holotype in Australian Museum. Reg. no. R. 7124.

*DENISONIA MACULATA*, *Steindachner*.

A re-examination of Krefft's type of *DENISONIA ORNATA*.

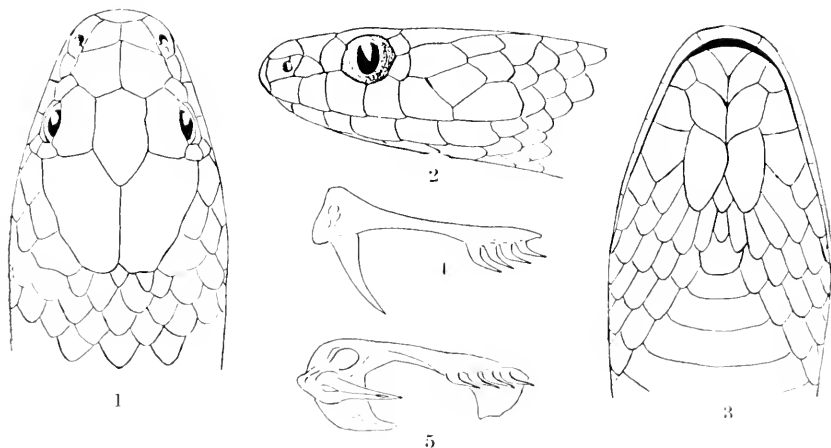
(Figs. 1-5.)

*Hoplocephalus maculatus*, Steindachner, Reise der Novara Reptiles, p. 81.  
*Id.*, Günther, Journ. Mus. Godeff., xii., 1876, p. 46.

*Denisonia ornata*, Krefft, Proc. Zool. Soc., 1869, p. 321, fig. 7, and Snakes of Australia, 1869, p. 82, pl. xi., fig. 4.

*Denisonia maculata*, Boulenger, Brit. Mus. Cat. Snakes, iii., 1896, p. 341.  
*Id.*, Waite and Longman, Rec. S. Austr. Mus., i., 3, 1920, p. 177, text fig. 35, pl. xxvii., fig. 1.

The loreal shield described by Krefft, and later stated by Günther to be accidental, is an abnormal, divided nasal, the division having taken place well behind the nostril, and its suture connecting with that of the internasals and prefrontals. This character is present on both sides of the head. In all other respects Krefft's type agrees with the description of *D. maculata*, as given by Mr. Boulenger.



Figs. 1-5.

As the original figures of this specimen do not show the head shields very clearly, and as they are not quite correctly delineated, I have re-drawn them as shown here (Figures 1-3).

Boulenger does not mention New South Wales as a locality from which this species has been recorded, but on looking through Steindachner's original description, I find that both his specimens are from this State, and it is noted that they were collected by the author.

*Maxillary bone*.—Examination of the maxillary bone shows that there is a very strong projection in front of the fang, and that this projection is much more pronounced than the corresponding one in *D. maculata*, var. *derisi*. The fang is followed by four sharp, strongly recurved, grooved teeth, and the distal portion of each is curved almost at a right angle to the basal portion (see figs. 4-5).

The palatine and pterygoid teeth are identical in shape with the maxillary teeth, but they are solid, there being no trace of grooves.

In the Australian Museum collection this species is represented by a single specimen, the type of *Denisonia ornata*, Krefft, which is from Rockhampton, Queensland. (Reg. no. 6697). Many other specimens which were previously placed as *D. maculata*, have proved to be *D. maculata*, var. *derisi*, of Waite and Longman.

*DENISONIA MACULATA* var. *DEVISI*, Waite and Longman.

(Plate xxvi., figs. 4-5, and Figures 6, 7, 8).

*Hoplocephalus ornatus*, De Vis, Proc. Roy. Soc. Qld., i., 1884, p. 100, pl. xv. *Id.*, Boulenger, Brit. Mus. Cat. Snakes, iii., 1896, p. 341.

*Denisonia maculata* var. *derisi*, Waite and Longman, Rec. S. Austr. Mus., i., 3, 1920, p. 178, Pl. xxvii., fig. 2, text fig. 36.



FIGS. 6-8.

In the Australian Museum collection there are twenty-six specimens which belong to this variety, and their localities show that they are not confined to western Queensland, as previously supposed. I wish to place on record their extension to, and over a wide tract of country in New South Wales. One specimen is labelled as having been collected at

Casino, on the North Coast, but there is a query after the name of the town: all the others, however, are authentically recorded from localities on the table lands and the plains west of the Great Dividing Range. The majority are from districts round about Moree, and Narrabri, two are from Quirindi, and the remainder from Bourke, Brewarrina, and Warren.

The series shows a fair degree of variation in the structure of the head shields.

The fang is followed by five sharp, strongly recurved, grooved teeth.

#### VARIATION.

*The Prefrontals.*—These shields are invariably larger than the internasals. The length of the centre suture of the respective shields varies in different specimens, that of the prefrontals generally being longer than that of the internasals, but in some specimens they are equal.

*Frontal.*—The shape of this shield is very variable. It may be broad in front, gradually narrowing posteriorly to the sutures of the parietals and supraoculars, or with a constriction at the centre, broadening a little towards the suture of the supraoculars and parietals, from which point it is produced backwards so as to form either an obtuse or an acute angle. In a few specimens the sides of the shield are almost parallel, with an obtuse angle anteriorly and an acute angle posteriorly. Its length in comparison to its breadth varies from once and one third, to once and three quarters as long as broad, but in the majority of specimens it is about once and a half times as long as broad. It may be as long as its distance from the rostral to a little longer than its distance from the end of the snout. It is nearly always once and one half times as broad as the supraoculars, but in one specimen it is only a fraction broader, in a second it is once and three quarters, while in two others it is twice as broad<sup>4</sup>.

*Parietals.*—The extreme length of this shield is about equal to the distance from the posterior border of the frontal to the posterior border of the rostral. The shape of its outer margin varies slightly according to the disposition of the surrounding scales.

*Pupil.*—This is elliptical throughout the series, but the comparative measurements of the ellipse vary somewhat, so that in two specimens it might be termed almost circular and in several others the shape of the pupil is different in the two eyes.

*Chin Shields.*—In the majority of specimens the posterior are longer than the anterior, but in three examples they might be termed equal in size and length.

*The Ventral Shields.*—The total numbers of these shields are from 124-139, and the subcaudals, 25-34, single. The ventrals and subcaudals added together number from 155-166.

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<sup>4</sup> This latter measurement may be abnormal, as it is certainly extreme, but in all other characters the specimen agrees with the majority.

*Colour markings.*—The dark cross bands on the body are generally very distinct; in some of the darker specimens they form more or less irregular mottlings, but can nevertheless be easily counted. In others, in which the body colour has become somewhat bleached through the action of preservative, the dark cross bands stand out very clearly. One specimen has as many as sixty-nine of these bands, two others have fifty-nine and sixty respectively, five have less than fifty, while eighteen others have round about fifty-three.

*Abnormal specimens.*—A few specimens have extra, or abnormal head shields, and may have three postoculars on one side and two on the other, while one specimen has three on each side. There also may be a small extra temporal, situated either anteriorly or posteriorly to the normal ones.

Two specimens from Moree, New South Wales, are very much swollen round the body through the presence of eggs. The head is considerably puffed behind the temporal regions, probably through the action of preservative on the tissue, and the general appearance is therefore not unlike that possessed by *Acanthophis*<sup>5</sup>. In one of these specimens, the frontal, if placed crosswise upon itself, would reach from one of its lateral borders to the outer edge of the opposite supraocular, and it is not as long as its distance from the end of the snout. In the other it is longer than its distance from the end of the snout and if placed crosswise upon itself would reach almost to the outer edges of both supraoculars. In the latter specimen the prefrontals have divided into four separate shields; in the former, the fifth upper labial has completely divided into two, making seven for that side of the head. In all other respects these abnormal specimens agree with the series examined.

The status of *DENDRELAPHIS SCHLENCKERI*, Ogilby.

(Plate xxvi., figs. 1-3).

*DENDRELAPHIS SCHLENCKERI*, Ogilby, Proc. Linn. Soc. N.S.Wales, xxiii., 3, 1898, p. 361, fig.

Having occasion to examine the type of the above species, which is in the Australian Museum, I found it to be identical with a well-known species of a different genus, viz. *Dendrophis calligaster*, Günther<sup>6</sup>, and on referring to my catalogue I found a note by the late Dene B. Fry to the following effect—"Australian Museum 21, xi., 1910.—Mr. T. Steel, who was responsible for the procuring of the types of this species, took home some co-types to Mr. Boulenger who said they were a well-known species, and not even in the right genus." As I cannot find any reference to this species in literature, other than that quoted above, I am taking

<sup>5</sup> It might be as well to mention here, that on several occasions when enquirers have brought *D. maculata* var. *derisi*, to me for identification, they have been under the impression that it was the Death Adder, *Acanthophis antarcticus*.

<sup>6</sup> Günther—Ann. Mag. Nat. Hist., 1867, xx. (3), p. 53, and Boulenger, Brit. Mus. Cat., Snakes, 1894, Vol. ii., p. 80.

this opportunity of defining its status, figuring it from the type, and giving some further details of its characters to supplement Ogilby's description, which was compiled from several specimens.

#### GENERIC CHARACTERS.

*Maxillary teeth*.—The type has twenty-one maxillary teeth and not twenty, as stated by Ogilby. The anterior one is very small, the second a little larger, while the third and onwards to the twenty-first might almost be termed subequal in length, but a few of the posterior ones are stouter than the anterior, this being a character of *Dendrophis*.

*Vertebral scales*.—These scales are slightly enlarged as in *Dendrophis*.

#### SPECIFIC CHARACTERS.

*Body scales*.—In the original description, those measurements which relate to the scaling, are the totals of the smallest and largest numbers, and for convenience I have recounted those of the type, which are as follows :—Scales in 13 rows. Ventrals 187. Sub-caudals 116. Anal divided.

*Temporals*.—These shields are different on the two sides of the head ; on the right side there are two upper and three lower, the upper anterior being as long as the first and second lower, while on the left side there are three pairs of shields.

*Labials and Chin shields*.—On the left side of the jaw there are five lower labials in contact with the anterior chin shield, the fifth just touching it, while there are only four labials in contact with the corresponding chin shield on the right side. The fifth is the largest, and the total number on each side is nine.

There are eight upper labials, and the fourth and fifth enter the eye. The posterior chin shields are much longer and narrower than the anterior, while the right anterior is divided into two in the type.

*Affinities*.—The characters of Ogilby's species are, in many cases, intermediate between those of *D. calligaster* and *D. punctulatus*<sup>7</sup>, as will be seen by the description, but those of the type are closer to the former species, under which name I have placed it.

Holotype in Australian Museum, Reg. no. R 2380.

Lonneberg and Andersson remark on two specimens in their possession, which are in many characters intermediate between *D. punctulatus* and *D. calligaster*, and they doubt whether the two species should remain distinct. I am inclined to agree with them, and hope at a later date to be able to go more fully into the question, and supply data that will either prove or disprove the validity of the latter species, or will enable more experienced workers to carry on the investigations to finality.

<sup>7</sup> In, Kungl. Sven. Vet. Akad. Handl., 1915, lii., 7, p. 8.

*PSEUDECHIS MORTONENSIS*, De Vis.

(Plate xxv., figs. 1-4).

*Pseudechis mortouensis*, De Vis, Ann. Qld. Mus. x., 1911, p. 24. *Id.*, Fry, Rec. Austr. Mus., x., 2, 1913, p. 18 (record only.) *Id.*, Longman, Mem. Qld. Mus. i., 1912, p. 24.

*Pseudechis porphyriacus* var. *mortouensis*, Waite and Longman, Rec. S. Austr. Mus. i., 3, 1920, p. 175.

This species was described from a single specimen from Brisbane, Queensland, in 1911. Since then several other specimens have been collected; one from Bundaberg is in the Queensland Museum, while there are three in the Australian Museum, one of them being from Eidsvold, Burnett River, Queensland, and the other from Willow Tree, New South Wales<sup>\*</sup>.

*Type of the species*.—I forwarded one of my specimens to Mr. Longman, Director of the Queensland Museum with the request that he might compare it with De Vis species, and he wrote to me as follows:—“There is no specimen in the Queensland Museum labelled as the type of *P. mortouensis*, and no specimen which fully agrees with De Vis' description. The specimen which may have been the type is at least 1250 mm. in length (it is now coiled); body scales 19 rows, ventrals 191; subcaudals 31½. It is difficult to reconcile the discrepancies in the caudal scales.”

The specimen which is 1250 mm. long, instead of 1035 as quoted by De Vis, appears to have most of the characters of his species; and, counting the tip of the tail, it has 32 single and 28 pairs of subcaudals, whereas De Vis counted 22 single and 38 pairs; if it be allowed that De Vis' figures have been reversed by a *lapsus calami*, or by a printer's error, the discrepancy disappears.

*Affinities*.—Waite and Longman, in a key to the species of *Pseudechis*, placed *P. mortouensis* as a variety of *P. porphyriacus*. This is evidently erroneous, since the latter species has only 17 rows of scales round the body, whereas *P. mortouensis* has 19. Mr. Longman also wrote to me as follows:—“We have also two blue-bellied black snakes from Pimpama, South Queensland with 17 rows of scales, and these are certainly colour varieties of *P. porphyriacus*. A blue-bellied specimen from Bundaberg, which has recently been received alive, and which has 19 scales round the body appears to me to be specifically distinct. There is thus a more or less blue-bellied form of the common black snake, *P. porphyriacus*, with 17 scales; and an allied but apparently distinct species, *P. mortouensis*, with 19 scales.”

The main structural differences between the two species are as follows:—*P. porphyriacus*, scales in 17 rows round the body, the frontal shield not broader than the supraocular, and only 5-20 of the subcaudals

<sup>\*</sup> This specimen was collected by Mr. W. W. Froggatt, Govt. Entomologist, and it establishes a new record for the species in this State.

are single. A fairly large series of this species in the Australian Museum collection prove these characters to be constant; furthermore, none of the specimens have more than 13 single subcaudals. In *P. murtomensis* the scales are in 19 rows round the body, the frontal is broader than the supraocular, and 22-10 of the subcaudals are single.

If it be accepted that De Vis' figures for the subcaudals in his species have been reversed, and should remain as 32 single and 28 paired, the difference between the two species would then be made even greater.

*Variation from the description of the type.*—The Burnett River specimen comprises a complete head, neck, and tail, but the body is represented by a flat skin, of which an inch or so appears to be missing. The posterior chin shields are a fraction longer than the anterior. Ventrals 175 (incomplete), subcaudals 59, of which 40 are single and 19 paired. In the New South Wales specimen the posterior chin shields are slightly longer than the anterior ones. The frontal is a little longer than its distance from the rostral, which is not quite as long as the internasals at their longest, and the upper portion as seen from above is contained nearly three times in its distance from the frontal. Ventrals 193. Subcaudals 51, of which 35 are single and 15 paired, plus an extra single one between the 6th and 7th pairs. In my definition of the species I have used all the information available, including De Vis' original description.

*Definition of the species.*—Eye longer than high, its vertical diameter contained once and one quarter to once and one half times in its distance from the mouth. Pupil round. Rostral one quarter broader than high, its upper surface about two and a half times shorter than its distance from the frontal. The suture between the internasals half as long as that between the prefrontals. Internasals about half the size of the prefrontals. Frontal a little broader than the supraocular, as long as, or a little longer than its distance from the rostral, once and one half times as long as broad, not as long as the suture formed by the parietals. The greatest length of the parietals is equal to the distance between the eyes. The nostril almost divides the nasal shield, the posterior portion of which is in contact with the single preocular. Oculars  $1 + 2$ , temporals  $2 + 2$ , (in the type  $2 + 0$  on one side), the lower anterior is the largest, and it is wedged in between the fifth and sixth upper labials. Six upper labials, the third and fourth entering the eye. The first three lower labials are in contact with the anterior chin shield which is equal in length to, or a little shorter than the posterior. Scales in 19 rows round the body. Ventrals 191-193. Subcaudals 59-61; 22-40 may be single, and 15 to 38 in pairs<sup>a</sup>.

*Colour.*—Shiny-black above, belly dark-grey, with a bluish tinge. The ventrals with a narrow darker tinge on their posterior edges. Subcaudals paler than the ventrals. The specimen from Willow Tree was

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<sup>a</sup> These figures include those in De Vis' original description, and should his count be incorrectly stated, the subcaudals, in my definition of the species should then read:—total number 59-61, of which 32-40 are single and 15-28 in pairs.

brought in alive, and, since being preserved, the colour of the upper surfaces tends to brownish; but the belly remains bluish-grey. The flat skin from the Burnett River has been in spirits for some years, and the brownish tinge is more evident than in the Willow Tree specimen.

Total length of specimen figured 1335 mm., of which the tail is 175 mm.

*Localities*.—Brisbane suburbs, type specimen, in Queensland Museum. Eidsvold, Burnett River, Queensland, in Australian Museum. Willow Tree, New South Wales, in Australian Museum, figured, Reg. no. R. 7114.

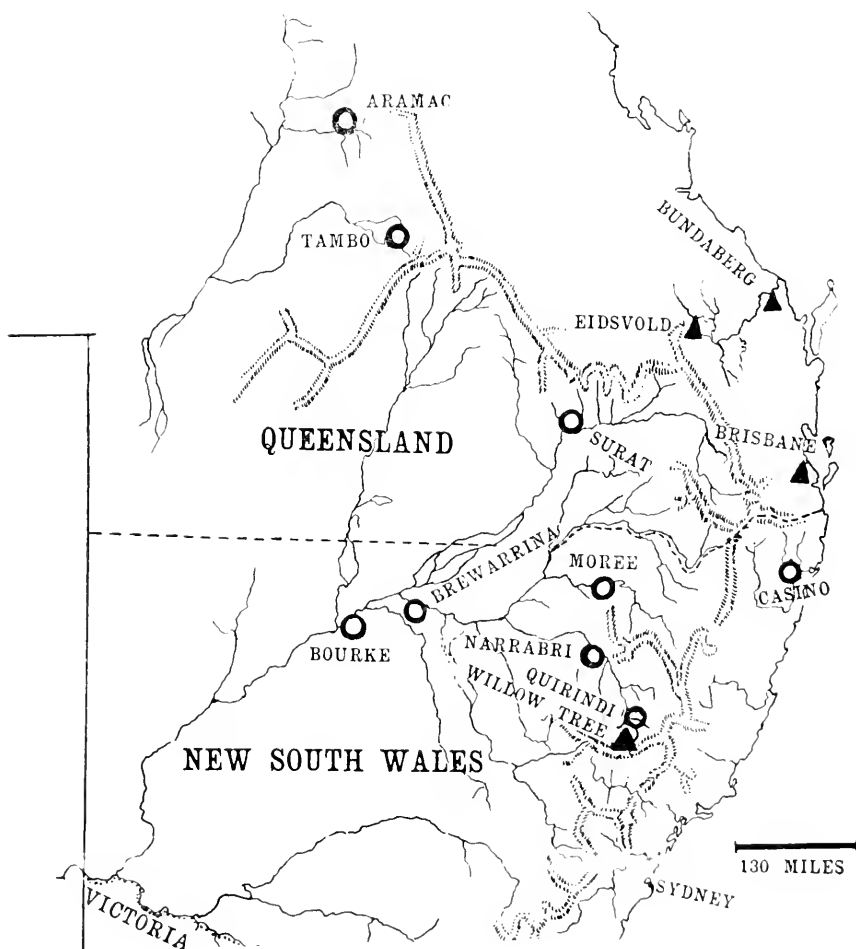


Fig. 9. Map of portion of New South Wales and Queensland, showing the distribution of *Deersonia sutu*, var. *depressa*, O and *Pseudochis mortoniensis*, ▲



## TWO AUSTRALIAN SPECIES OF *DITRYPA*

BY

REV. W. BRETHERTON, Invertebrate Zoologist, The Australian Museum

(Figures 1-2).

In 1877 Brazier<sup>1</sup> placed before the Linnean Society of New South Wales the continuation of his examination of the Mollusca collected during the "Chevert" Expedition, including among these results his description of a new species of *Dentalium*. This species was named by him *Dentalium laevis*, and his description, unaccompanied by a figure reads:

"Shell light amber colour, sometimes white, smooth, glossy, strongly arched, half-moon shaped, basal margin pinched in about two lines long, forming somewhat like a shoulder, then slightly ventricose, from that to the apex regularly tapering, apex with a minute perforation, entire.

Length, 14 lines: diam. of base at shoulder, 1; below,  $\frac{1}{2}$  line."

At the conclusion of his description Brazier remarks that "The lower part of this species resembles the spines of Sea Urchins (*Echinida*). The greater part of the specimens are encrusted over with a fine coating of coral-like substance."

To the description the following localities are appended: Princess Charlotte Bay, North-East Australia, 13 fms., sandy mud; Cape Grenville, North-East Australia, 20 fms., mud; York Island, Torres Straits, 13 fms., hard mud bottom; Darnley Island, Torres Straits, 5, 15, 20, 30 fms., mud, sand and sandy mud bottom.

These specimens are housed in the Macleay Museum at the University of Sydney, and I am indebted to Mr. John Shewan for his courtesy in placing them at my disposal for examination.

As a *Dentalium* the specific name of *laevis* had been preoccupied by Schlotheim<sup>2</sup> and Turton,<sup>3</sup> and was again used by Hilgard and Hopkins<sup>4</sup> in 1878. In the Manual of Conchology Pilsbry and Sharp refer this form to *Cadulus* ? *laevis*, Brazier, and make the following remark:—"Described as *Dentalium*, the specific name being preoccupied. It seems to be a *Cadulus* or a *Ditrypa*. We have not seen specimens, but the last clause of Brazier's observations suggest the latter genus."

An examination of the "Chevert" material in the Macleay Museum, and of the material in the Australian Museum (paratypes) shows that *Dentalium laevis* may be definitely removed from the Mollusca to the Annelida; and in considering the geographical distribution of these forms, my conclusions point to the improbability of this being referable to the European *Ditrypa cornea*, and it is therefore regarded as a new species.

<sup>1</sup> Brazier—Proc. Linn. Soc. N.S.Wales, ii., 1, 1878, p. 59.

<sup>2</sup> Schlotheim—Die Petrifactenkunde, 1820, p. 93 (as *Dentalites laevis*).

<sup>3</sup> Turton—Conch. Dict. Brit. Is., 1819, p. 256.

<sup>4</sup> Hilgard and Hopkins—Rep. Borings Mississippi River and Lake Borgne (Engr. Dept. U.S. Army), 1878, p. 48, pl. iii., fig. 6.

*DITRYPA BRAZIERI, sp. nov.*

(Figure 1).

*Dentalium luteo*, Brazier, Proc. Linn. Soc. N.S.Wales, ii., 1, 1878, p. 59.*Cubulus lueris*, Brazier, Hedley, Proc. Linn. Soc. N.S.Wales, xxx., 3, 1900, p. 499, pl. xxvi., figs. 8, 9, 10. *Id.*, Hedley, Rec. Aust. Mus., iv., 3, 1901, p. 129.*Cubulus ? lueris*, Brazier, Pilsbry and Sharp, Man. Conchology, xvii., 1897-8, p. 195.

Shell curved and tapering; 1 mm. in diameter at the broadest part of the posterior end, the walls of which, for 2 mm. from the posterior opening, incline sharply to form the frustum of a cone. Orifice at the anterior end minute and entire. Surface smooth, porcellaneous, or encrusted with adherent patches of nullipore. Colour white to yellowish brown. Texture earthy.

Average length of "Chevert" specimens, 14 mm.

Holotype in the Macleay Museum, University of Sydney.

A second form which differs from the other described forms of *Ditrypa* has been added to the collections of the Australian Museum. It is from 20 fathoms between Cairns and Endeavour Reefs, Queensland, collected by Mr. A. R. McCulloch of the Australian Museum, September 9, 1918. While these are the only specimens in the collections, Mr. Hedley informs me that this form has constantly occurred in dredgings that he has examined from the coast of North Queensland. I have to thank Mr. F. Chapman of the National Museum, Melbourne, for his examination and verdict that this form is a true *Ditrypa*.

*DITRYPA AUSTRALIS, sp. nov.*

(Figure 2).

Shell very slender, curved and tapering. Orifice at the anterior end minute and entire. The walls of the posterior opening are thickened and slightly contracting in perfect specimens. Surface smooth or porcellaneous. Texture earthy. Colour dirty white to grey. Average length, 8 mm.

Holotype in the Australian Museum (F. 17609).

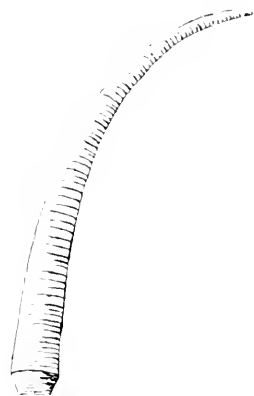


FIG. 1.

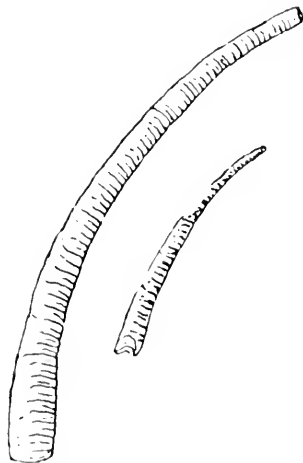


FIG. 2.

# STUDIES ON BRYOZOA

## PART I

BY

REN. W. BREINALL, Invertebrate Zoologist, The Australian Museum

(Figures 1-3)

### NEOEUTHYRIS: A NEW GENUS TO ACCOMMODATE *EUTHYRIS* WOOSTERII, *MacGillivray*.

In a paper read before the Royal Society of Victoria, MacGillivray<sup>1</sup> included his description of a new species which he named *Euthyris woosteri*. His description was based on the superficial characters of a small fragment of a specimen collected by Mr. W. H. Wooster at Cooktown, Queensland; and with his description MacGillivray gives his reasons for allotting this form to the genus *Euthyris*.

The holotype is housed in the collections of the National Museum, Melbourne, but the Australian Museum has now acquired the remainder of the original specimen from Mr. Wooster.

This species has not again been referred to by the many authorities on the *Bryozoa*, with the exception of the following remark by Harmer<sup>2</sup>, which has led me to re-examine it. "I feel doubtful whether *Euthyris woosteri*, MacGillivray, is rightly referred to this genus . . . . ."

The results of my examination show that "*Euthyris*" *woosteri* has, with one exception, all the characters entitling it to a place in the family Euthyridæ, according to Levisen's diagnosis<sup>3</sup>:—"The *zoecia* are provided with a slightly calcified cryptocyst, and in a larger or smaller part of their surface the surrounding covering membrane is kept distended by ridge-like or rod-shaped processes from the cryptocyst, which has a number of superficial rosette-plates. The interzoecial walls have scattered, uniporous rosette-plates. A compound operculum. No spines and no heterozoecia. There may be endozoecial *ooecia* with a projecting ectoecium."

The exception in the case of this form is in the last line of Levisen's diagnosis, which reads "Free, branched colonies." The small specimen obtained by Mr. Wooster was found encrusting marine algae, but what value may be placed on this habit of growth I do not know. MacGillivray and others consider it to be of little importance, and I am of the opinion that the encrusting habit of "*Euthyris*" *woosteri* does not over-ride the structure and give enough reason to place it as yet in a separate family. It must however be considered as generically distinct from the other forms of the family Euthyridæ, and I propose the name of *Neoeuthyris* to accommodate it. From the other genera of the family its differences will be seen from the key. It is closely allied to *Euthyris*, differing firstly in having only one form of the zoecium with no dimorphism of the operculum; and secondly in the presence and disposition of the avicularia.

<sup>1</sup> MacGillivray—Proc. Roy. Soc. Vict., (n.s.) iii., 1891, p. 77, pl. ix., f. 2.

<sup>2</sup> Harmer—Q. J. Mic. Sci., (n.s.) xlvii., 1902, p. 268.

<sup>3</sup> Levisen—Morph. and Syst. Stud. Cheilostomatous Bryozoa, 1900, p. 269.

## GENERIC KEY.

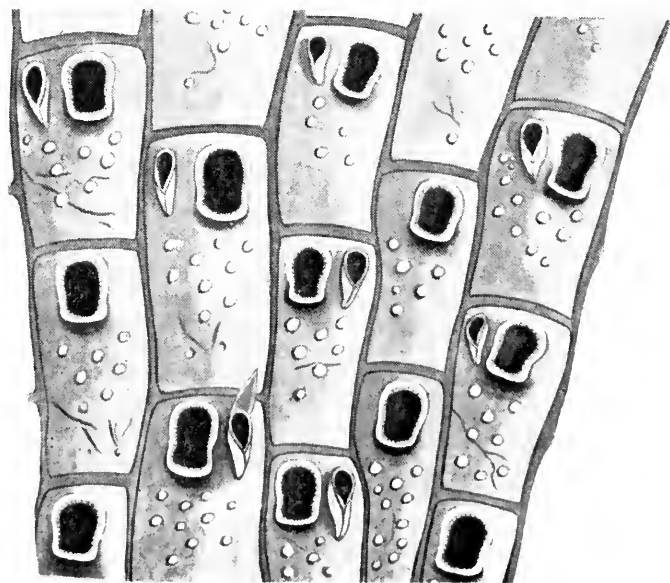
4. Ooclia occur. The aperture is provided with a narrow sinus. The covering membrane is everywhere kept distended by narrow ridges from the cryptocyst..... *Urecolipora*.
3. No ooclia, but two different forms of zoecia are present. The aperture without a sinus, and with an almost straight proximal margin.
  - a. The frontal cryptocyst forms a continuous calcareous surface; the covering membrane is on the frontal, as well as the basal surface, distended by means of rod-shaped processes from the cryptocyst..... *Euthyris*.
  - b. The frontal surface of the cryptocyst is formed by a number of narrow, and only partially meeting ribs; the covering membrane is kept distended only on the basal surface of the colony by means of a wedge-shaped, and projecting central portion of the separate zoecia..... *Pleurothyris*.
- c. No ooclia and one form of zoecium. Aperture without a sinus and with a slightly hollowed proximal margin. The covering membrane is on the frontal as well as the basal surface, kept distended by means of rod-shaped processes from the cryptocyst. An avicularium may be situated to the right or the left of the aperture..... *Neorothyris*.

## NEORTHYRIS WOOSTERI, MacGillivray.

(Fig. 1).

*Euthyris woosteri*, MacGillivray, Proc. Roy. Soc. Viet. (n.s.) iii., 1891, p. 77, pl. ix., f. 2. *Ibid.* Harmer, Q. J. Micr. Sci. (n.s.) xlvii., 2, 1903, p. 268.

Zoecia slightly calcified, arranged alternately in a longitudinal series, elongate oval in shape, and rounded anteriorly but flattened basally.

Fig. 1. *Neorothyris woosteri*.

The covering membrane is hyaline, thickly covered with irregularly sized and arranged, minute elevations, and indistinctly marked with longitudinal grooves. Aperture lofty, broadly arched, contracted at the lower third, the proximal margin slightly hollowed. A compound operculum is present. A large avicularium may be situated to the right or the left of the aperture in the majority of the zooecia; it is broad above, with a triangular mandible produced into a downwardly projecting acuminate process. Numerous uniporous rosette-plates are present on the inter-zooecial walls, and the covering membrane is kept distended by chitinous filiform or rod-shaped processes. Oocia absent. Colony encrusting on marine algae.

*Locality*.—Cooktown, Queensland.

*Paratype* in the Australian Museum (U. 875).

*Obs.* From Levinsen's<sup>1</sup> observations on a supposed form of *Euthyris oblecta*, Hincks, in which he mentions that the single form of operculum is present, and remarks that it may be regarded as a new species, I should think that this form described may be referable to *Necothyris*.

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#### ON POLLAPLOCYCIUM.

In September of last year the Rev. Dr. Thos. Porter of Petersham, N.S.Wales, presented two slides of Bryozoa to the Australian Museum representing, as he contended, a new species of *Pollaplocyium*.

The specimens from which these slides were prepared were dredged in Bass Strait by Mr. J. Wilson of North Fitzroy, Victoria, a gentleman to whom microscopical science owes much, and it is with pleasure that I associate his name with this new species.

The genus *Pollaplocyium* was created by Maplestone<sup>2</sup> to accommodate his new form from the Gilbert Islands. He remarks on the differences between this and *Diplocyium*, but with Kirkpatrick<sup>3</sup> he does not allot his genus to a family. I have not seen *Diplocyium*, but my examination of the species about to be described, and the paratype of *P. gilbertensis*, shows that *Pollaplocyium* should be accommodated in the family Onchoporidae according to Levinsen's<sup>4</sup> diagnosis:

"The slightly calcified zooecia, the frontal surface of which is covered by a closely adhering (chitinous?) membrane, are generally provided with

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<sup>1</sup> Levinsen—l. c. p. 273.

<sup>2</sup> Maplestone—Proc. Roy. Soc. Vict., (n.s.) xxi., 2, 1906, p. 417.

<sup>3</sup> Kirkpatrick—Ann. Mag. Nat. Hist., (6) i., 1888, p. 73.

<sup>4</sup> Levinsen—l. c. p. 259.

a number of superficial, uni- or multiporous rosette-plates, which are most often situated in the distal part of the zoecium. The distal wall, which is bent from side to side, has a number of uniporous or one multiporous rosette-plate, while the distal half of each lateral wall has a single multiporous plate. No *aricularia*. The strongly projecting hyperstomial *ooecia*, the aperture of which may be closed by the zoecial operculum, consist of two membranous (chitinous?) layers, between which there is a cryptocyst layer, which springs from the distal wall. Free, branched colonies."

The key to the genera of this family, accommodating *Pollaploecium*, is thus presented.

- A. The compensation sac opens outwards through a crescentic ascopore.
  - a. The zoecium consists of three different segments, a short proximal, a long stem-like middle, and a widened distal one. The operculum may be compound or simple..... *Calwellia*.
  - b. The zoecium does not consist of three different segments.
    - ba. A simple operculum. The oecia with two proximal and free rib-like processes..... *Onchopora*.
    - bb. A compound operculum. The oecia without free rib-like processes..... *Onchoporella*.
- B. The compensation sac does not open outwards through a pore, but immediately on the proximal side of the operculum.
  - a. Without pores..... *Onchoporeoides*.
  - b. With pores..... *Pollaploecium*.

*POLLAPOECIUM WILSONI*, *sp. nov.*

(Fig. 2).

*Polyzoary*.—A free branching colony, made up of internodes of ten to twelve zoecia situated back to back. Internodes connected by short corneous tubes.

*Diagnosis*.—Zoecia pyriform, slightly calcified and covered by a closely adhering membrane. The aperture is directed sideways, semiobicular in shape and with a short spine at each side of the hollowed lower border. The frontal surface is covered by large and irregularly placed circular pores, and occasional small spine-like processes. Oecium globose, situated above and continuous with the zoecium, a slight suture showing the line of demarcation. Avicularia absent.

*Colour* (in Canada Balsam) brown.

*Locality*.—Bass Strait, Tasmania.

*Holotype* and *Paratype* in the Australian Museum (U.878 and U.879).

A paratype of *Pollaploecium gilbertensis*, Maplestone, is in the collection of the Australian Museum, and from the following figure and description its differences from *P. Wilsoni* will be seen.

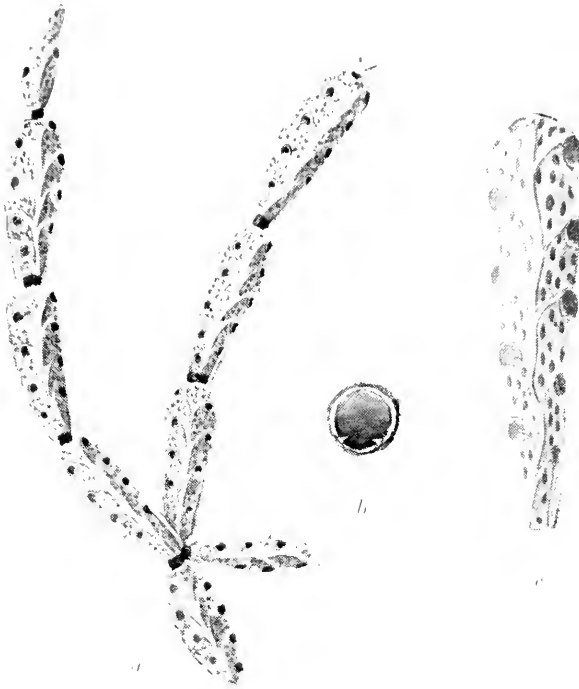


FIG. 2. *Pollaploecium wilsoni*. a Polyzoary enlarged. b Orifice. c Internode cleared and enlarged.

*POLLAPLOECIUM GILBERTENSIS*, Maplestone.

(Fig. 3).

*Pollaploecium gilbertensis*, Maplestone, Proc. Roy. Soc. Viet., (n.s.) xxi., 2, 1909 p. 417, pl. xxviii., f. 18.

*Polyzoary*.—A free branching colony made up of internodes of from six to ten zoecia situated back to back. Internodes connected by short corneous tubes.

*Diagnosis*.—Zoecia oval or pyriform, ventricose, slightly calcified and covered by a closely adhering membrane. The aperture is strongly

arched above with a straight lower border bearing a deep central sinus. The frontal surface is minutely punctate, but otherwise without decoration.



FIG. 3. *Polaploecium gibbertensis*. a Polyzooty enlarged. b Orifice.

The oecia are situated above and are continuous with the zoecia, a slight suture showing the line of demarcation. Avicularia absent.

*Colour* (dry) dirty white.

*Locality*.—Marshall Group, North Pacific Ocean.

*Paratype* in the Australian Museum (U. 877).



## A REVISION OF THE AUSTRALIAN *TRIDACNA*.

BY

CHARLES HEDLEY.

(Plates xxvii.-xxxiv., and Figure 1).

From the earliest times the *Tridacna* shells, on account of their huge size, have attracted the notice of naturalists, so that the pioneers of conchology more than a hundred years ago already had collected a large body of information about them. But modern zoologists have not found much more to add, perhaps because the subject was considered to be exhausted. Yet the history of the habits, affinities and nomenclature of this curious genus is still far from complete.

A *Tridacna* occurring abundantly in the Gulf of Suez was examined by Dr. Leon Vaillant. He determined it, probably erroneously, as *Tridacna elongata*, Lamarek, and described it<sup>1</sup> as buried in sand so that the serrate margin of the valves alone projected and as moored by a profuse byssus hawser to the stone beneath; he adds that the bivalve may change its position and even move to a distance. Vaillant concluded that all other members of the genus *Tridacna* have similar habits and disparages those writers and travellers whose observations differ from his own. Thus he doubted the accuracy of the account of the large, fleshy foot given independently by Quoy and Gaimard<sup>2</sup> and by Woodward.<sup>3</sup> In reference to the statement that *T. crocea* lives buried in coral, Vaillant supposes that it could not actually excavate the stone and must therefore have been enveloped by an over growth of the living coral polyps. These views, advanced with so much authority, seemed to have gained general acceptance.

In Australia, *Tridacnidae* do not behave as Vaillant describes. Certain Pacific species do carve holes in stone just as actively as *Pholas* does on European coasts. Other species remain on the surface, either unfastened or clinging to the rock by the foot.

So *Tridacna* are divisible into the smaller species that burrow and the larger ones that lie on the surface. Australian burrowing species are *T. maxima*, *T. elongata* and *T. crocea*, the great size of the pedal aperture at once distinguishing any borer from any perching species; the non-boring

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<sup>1</sup> Vaillant—Ann. Sci. Nat. 5 Ser. Zool., iv., 1865, p. 71.

<sup>2</sup> Quoy & Gaimard—Voy. Astrolabe, Zool., iii., 1835, p. 490, Moll., Pl. lxxx., fig. 3.

<sup>3</sup> Woodward—Ann. Mag. Nat. Hist. (2). xv., 1855, p. 100.

kinds, *T. decusa*, *T. gigas*, *T. natica* and *T. squamosa* together with *Hippopus* may lie loose and quite unattached to the surface either by foot or byssus. In my experience *Tridacna* are never found on sand or mud, but only on coral.

The first glimpse that a traveller has of a living, boring *Tridacna* is usually an apparition of a brilliantly coloured, round serpentine worm, six or eight inches long, lying in dead coral. If he attempts its capture, the worm vanishes with a click, and the locked teeth of the valve margin grin at him in its place.

A lump of Astrean coral is here shown (Pl. xxxii., fig. 10) in which a specimen of *T. crocea*, about three inches long has sunk so deeply that the upturned edges of the valves are level with the surface of the rock. It was collected at Dunk Island, Queensland by Mr. E. J. Banfield who figured it in "My Tropic Isle," 1911, p. 126. The summit of the block appears to have been dead when the *Tridacna* settled there. Since then the coral colony grew up from the base again, the polyps intruded on the anterior end of the cell and were abraded by the foot of the mollusc. Boring *Tridacna* are always, as far as my memory serves me, found in dead, not in living, coral and that a sedentary *Tridacna* might become imprisoned by being enclosed in living coral would, I think, be a rare accident. The burrow is smooth inside and is large enough to allow considerable movement to and fro and of opening the valves from side to side. But the entrance is narrower than the chamber both in length and breadth, so that even a single valve cannot be withdrawn through the opening without breaking it.

An early stage in burrowing is represented by Plate xxxiv., fig. 13. Here a young *T. crocea*, 35 mm. long has begun to operate on a pebble of dead and much worn coral. I gathered this specimen on the beach at Green Island, Queensland. It well illustrates the fact that the cell of a buried *Tridacna* is formed not by the envelopment of growing coral but by the penetration of the mollusc into dead coral. In this case the burrow is driven obliquely, the left valve being deeper sunk than the right and the dorsal deeper than the ventral end, about one third of the left and a sixth of the right valve are submerged. The dorsal posterior angle is lifted clear and the anterior ventral angle is just covered. At this stage the bivalve could probably withdraw and commence another hole, but further excavation would entail imprisonment for life. Under denudation the dead coral melts away rapidly, so that whether the mollusc descended into the rock perpendicularly or obliquely the entrance to the cell would be removed by weathering of the rock surface and the route lost.

A young specimen of *T. crocea*, 18 mm. in length (Pl. xxxiv., fig. 14), has a pedal opening of 3 x 8 mm. But in a specimen 31 mm. long this aperture has increased disproportionately, being 15 x 7 mm. (Pl. xxxiv., fig. 15). Probably this indicates that the larger shell had reached a time of life in which burrowing became of greater importance.

Among dredgings from the Great Barrier Reef, about the latitude of Cairns, I was so fortunate as to find three minute valves of a *Tridacna* too young to name specifically. The smallest is 1.5 in height and 1.1 mm. in length; the next 2 high and 1.85 mm. long (Pl. xxxiv., fig. 18); the largest 2.7 high, 2.1 long and 0.6 mm. deep (Pl. xxxiv., fig. 16); the height and length being measured at right angles to each other. In the youngest stage, the dorsal, anterior and posterior-ventral sides are nearly equal, forming an equilateral triangle. As the shell grows it becomes more wedge-shaped, the height rapidly increases and the posterior slightly outgrows the anterior end. There is no gape, but the anterior margin is beset with denticles. The anterior side is flattened and sculptured by finer riblets. The back of the valve carries five broad crescentic ribs furnished with scales, their interstices have finer riblets. There is a small dome-shaped prodissoconch. The hinge line is straight. The shell is too transparent to show the muscle scars. In the left valve are two extended posterior teeth, in the right one and in each valve a single minute cardinal.

The orientation of this irregular shell has been a matter of such difficulty that the valve which one author, Vaillant, terms the left, is by another writer, Lacaze-Duthiers,<sup>4</sup> called the right. I would proceed by assuming that the hinge is, as usual, dorsal, and that the beaks are directed, as usual, anteriorly. Then it will follow that the pedal gape is, as Lacaze-Duthiers argued, on the anterior side and that the richly coloured mantle exposed by the animal living in the burrow, is posterior.

Systematists, following Lamarek, have arranged *Tridacna* next to *Cardium*. It is now contended that a more natural allotment would associate *Tridacna* with the mytiloid *Carditidae*. Both are rock dwellers and one species of *Cardita* was even named *tridacnoides* because of its resemblance to the big clams. Such classification better explains the direction of evolution followed by *Tridacna*. Beginning with a normal *Urelicardia*, the path of distortion leads first to an elongate form, such as *U. turpida*, Lamarek (*Cardita incrassata*, Sowerby) in which the anterior side has become shorter and the anterior adductor muscle has ascended. Another step is represented by such forms as *Bequima semiorbiculata*, Linné or *Cardita crassicosta*, Lamarek. Here the anterior extremity has pushed out into a lobe, followed by an insinuation at the byssal slit, the anterior adductor muscle has made a further ascent towards the umbo. The furrow of the lunule, almost swallowed beneath the over rolling umbo, is hardly visible except as a notch in the hinge line. The final stage in elongation, compression and twisting is represented in *Tridacna*. At last, the anterior lobe of the mytiloid *Carditidae* has been squeezed out of existence, the byssal gape has been enlarged to form the pedal orifice of *Tridacna*, the anterior adductor muscle has moved on, under and past the umbo while

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<sup>4</sup> Lacaze-Duthiers—Archiv. Zool. Exper. (3), x., 1902, p. 208.

the umbo has curled over and concealed the lunule furrow. The consequent pivoting of the animal in its shell has brought the foot from the ventral to the anterior margin (Pl. xxxiii., figs. 11, 12).

The Australian species of *Tridacna* are as follows :—

*TRIDACNA CROCEA*, Lamarek.

(Plate xxx., fig. 5).

*Chama gigas* var. C., Dillwyn, Descrip. Cat., i., 1817, p. 244, for Chemnitz.  
Conch. Cab., vii., 1784, p. 124, pl. xlix., fig. 496.

*Tridacna crocea*, Lamarek, An. s. vert., vi., pt. i., 1819, p. 106. *Id.*, Encyclopedie Meth., pl. cccxxv., fig. 2. *Id.*, Chem. Illustr. Conch., 1845, p. 2, pl. iv., fig. 2. *Id.*, Woodward, Ann. Mag. Nat. Hist. (2), xv., 1855, p. 100. *Id.*, Reeve, Conch. Icon., xiv., 1862, pl. viii., fig. 9. *Id.*, Kuster, Conch. Cab., 2 Ed., viii., 4, 1868, p. 6, pl. i., fig. 6. *Id.*, Tapparone Canefri, Bull. Soc. Zool. France, iii., 1878, p. 276. *Id.*, Martens in Mobius Meersfaun. Mauritis., 1880, p. 323. *Id.*, Sowerby, Thes. Conch., v., 1884, p. 181, pl. cccclxxxvi., fig. 6, pl. cccclxxxvii., figs. 9-10. *Id.*, Smith, Chall. Exped. Zool., xiii., 1885, p. 170. *Id.*, Hidalgo, Mem. R. Acad. Cienc. Madrid, xxi., 1903, p. 397. *Id.*, Lynge, D. Kgl. Danske Vidensk. Selsk. Skrifter, 7, t. v., 1909, p. 263. *Id.*, Hedley, Report Austr. Assoc. Adv. Sci., xii., 1910, p. 348. *Id.*, Hirase, Illustr. Thousand Shells, Pt. 3, 1915, pl. xxix., fig. 143.

*Chamaetrachaca crocea*, Frauenfeld, Verhandl. K. K. Zool. Bot. Ges. Wien, xix., 1869, p. 884.

*Tridacna mutica*, Quoy & Gaimard, Zool. Astrolabe, iii., 1835, p. 490, pl. lxxx., figs. 1-3 (not of Lamarek).

*Chamaetrachaca scapha*, H. & A. Adams, Gen. Rec. Mollusca, ii., 1857, p. 465, pl. cxiii., fig. 2. *Id.*, Schmeltz, Cat. Mus. Godeffroy, v., 1874, p. 172.

*Tridacna ferruginea*, Reeve, Conch. Icon., xiv., 1862, pl. viii., fig. 8.

*Tridacna cunningii*, Reeve, Conch. Icon., xiv., 1862, pl. vii., fig. 7.

*Patou-a*, Lesson, Dict. Class. d'hist. nat., xiii., 1862, p. 29.

*Hab.*—Cape York, 8 fath. (Challenger Expedition). Hope Islands (Hedley). Dunk Island (Banfield), Queensland.

TRIDACNA DEKASA, *Bolten*.

(Plate xxviii., fig. 4).

*Tridacna dekasa*, Bolten, Mus. Bolt., 1798, p. 172, for Chemnitz, Conch. Cab., viii., 1784, p. 125, pl. xlix., fig. 497.

*Chama gigas*, var. D., Dillwyn, Descrip. Cat., 1., 1817, p. 214.

*Tridacna mutica*, Chemn. Illustr. Conch., 1845, Tridacna, pl. iv., fig. 1 (not *T. mutica*, of Lamarck).

*Tridacna serrifera*, Lamarck, Anim. s. vert., vi., 1., 1819, p. 107. *Id.*, Encycloped. Meth., Pl. ccxxxv., fig. 3. *Id.*, Hanley, Cat. Rec. Bivalv. Shells, 1856, p. 232, pl. xxiv., fig. 21. *Id.*, Reeve, Conch. Icon., xiv., 1862, pl. vi., fig. 6. *Id.*, Kuster, Conch. Cab., 2 Ed., 1868, pl. i., fig. 1. *Id.*, Melvill & Standen, Journ. Linn. Soc. Zool., xxviii., 1899, p. 189. *Id.*, Hidalgo, Mem. R. Acad. Cienc. Madrid, xxi., 1903, p. 395.

*T. squamosa* var. *serrifera*, Sowerby, Thes. Conch., v., 1884, p. 180, pl. cccclxxxix., fig. 17.

*Tridacna obesa*, Sowerby, Proc. Malac. Soc., iii., 1899, p. 210-211, text figs.

There is a specimen in the Australian Museum collection 15 inches long. Probably the type of *T. dekasa*, is contained in the Copenhagen Museum.

*Hab.*—Murray Island, Torres Strait (Haddon and Hedley).

TRIDACNA ELONGATA, *Lamarck*.

(Plate xxx., fig. 8).

*Tridacna elongata*, Lamarck, Anim. s. vert., vi. (1), 1819, p. 106. *Id.*, Chemn. Illustr. Conch., Tridacna, 1845, p. 1, pl. i., fig. 2, pl. ii., figs. 1, 2, 3. *Id.*, Menke, Moll. Nov. Holl., 1843, p. 39. *Id.*, Iredale, Proc. Zool. Soc., 1914, p. 666. *Id.*, Hedley, Proc. Geogr. Soc. S. Australia, viii., 1918, p. 267 (not *T. elongata* of Reeve, Kuster or Sowerby).

*Tridacna lanceolata*, Sowerby, Thes. Conch., v., 1884, p. 181, pl. cccclxxxix., fig. 19.

*Tridacna roerei*, Hidalgo, Mem. R. Acad. Cienc. Madrid, xxi., 1903, p. 389, for Reeve, Conch. Icon., xiv., pl. ii., fig. 2b.

The identity of this form has been enveloped in confusion. Lamarck originally included under the head of *T. elongata*, three varieties, "a," "b" and "c"; the shell of "a" being particularly distinguished as being 15 centimetres long. Chemn. who then had custody of Lamarck's shells, published drawings of *T. elongata* (Pl. ii., figs. 1, 1a, 1b), of exactly this length and it therefore seems reasonable to regard these figures as representing the type. Because Lamarck did not clearly differentiate *T. elongata* from such species as *T. maxima*, Bolten (Encyclop. Meth., Pl. cxxxv., fig. 1), *T. imbricata*, Bolten (Savigny, Egypte, Pl. x., fig. 1) or *T. elongatissima*, Bianconi (Reeve, Pl. x., fig. 5), subsequent authors were led by such loose arrangement to take various views of *T. elongata*, transferring that name to other species and effacing the species itself under the name of *Tridacna lanceolata*.

According to current determinations, *T. elongata* reaches north, south, east and west to the utmost limits of the genus, viz.—to the Jima Islands, Japan (Pilsbry, Cat. Marine Moll. Japan, 1895, p. 182), Lord Howe Island, South Pacific (Brazier, Mem. Austr. Mus., ii, 1889, p. 28), Mangareva, Gambier Islands (Lamy, Bull. Mus. d'hist. nat., xii., 1906, p. 215) and to Suez, Red Sea (Issel, Malacologia Mar Rosso, 1869, p. 79).

*Hab.*—Monte Bello Island (Iredale), and Sunday Island, Kings Sound (Basedow), Western Australia.

#### TRIDACNA GIGAS, Linné.

(Plate xxvii., figs. 1-2).

*Chama gigas*, Linné, Syst. Nat., x., 1758, p. 691. *Id.*, Hauley, Ips. Linn. Conch., 1855, p. 85.

*Tridachnes nova*, Bolten, Mus. Bolt., 1798, p. 171, for *Chama gigas*, Chemnitz, Conch. Cab., vii., 1784, pl. xlix., fig. 494.

*Tridacna gigantea*, Perry, Conchology, 1811, p. 2. *Id.*, Hedley, Proc. Linn. Soc. N.S.Wales, xli., 1917, p. 686.

*Tridacna rudis*, Reeve, Conch. leon., xiv., 1862, pl. v., fig. 1. *Id.*, Sowerby, Thes. Conch., v., 1884, p. 182, pl. cccclxxxviii., figs. 13, 14. *Id.*, von Martens, Zool. Forch. Semon, 1894, p. 91.

*Tridacna gigas*, Kent, Great Barrier Reef, 1893, p. 11, pl. xxix (Giant Clam alive in situ on the Reef). *Id.*, Hedley, The Nautilus, xv., 1902, p. 98. *Id.*, General Guide to American Museum, 1916, p. 97.

*Apaton*, Ferussac, Dict. class. d'hist. nat., i., 1822., p. 136.

*Kima*, Blainville, Dict. Sci. Nat., xxiv., 1822, p. 430.

*Morscor*, Jukes, Voy. Fly, ii, 1847, p. 286.

The Giant Clam is a conspicuous figure on the outlying reefs of the Great Barrier. Even yet there is some uncertainty about its synonymy and development. It is possible that two or more species distinct in youth may converge in age till they are alike Giant Clams.

In aged individuals,<sup>5</sup> the cardinal teeth increase disproportionately, the laterals tend to atrophy, the pedal orifice closes and the external sculpture of the valve becomes obliterated. When the characters which distinguish smaller shells from each other, thus disappear in senility, recognition of the earlier stages of the Giant Clam depends on tracing the species backwards through a series of young and younger individuals. On analysis the first point is that the Giant Clam is a perching and not a boring form, secondly, the ribs at the margin have the scales more crowded than in *T. squamosa*, thirdly, the Giant Clam is more inequilateral than are *T. antica* or *T. squamosa*. From these, I conclude that the Giant Clam is the adult of what is generally known as *T. radix*, Reeve, but which was earlier named *T. novæ* by Bolten. In his original introduction of the name, Linné cited a figure of *T. novæ* from Argenville (*Conchyliologie*, 2 ed., 1757, pl. xxiii., fig. e).

Of what is now the genus *Tridacna*, Linné perceived only a single species, his *Chama gigas*. The accepted usage of the name *Tridacna gigas* was unchallenged until Hanley reported that one of two specimens in the Linnean private collection was *T. squamosa*, and the subsequent redescription of the Museum Ulricæ best suited the same species. But, on the contrary, the Linnean specimen of *T. squamosa* cannot be considered a type; whereas the shell in the Royal Museum noted in the original description as weighing 532 pounds, has every claim to be the Linnean type, which is perhaps still extant at Uppsala. Granting this, Lamarek may be endowed with the authority of the first reviser in dealing with the Linnean complex, and his separation of *T. squamosa* from *T. gigas* approved as a correct procedure.

Captain Flinders when on a voyage of discovery in Torres Straits in 1802, made the following observations:—"There being no water on the Island (Half-way Island), they (the Indians) seem to have hit upon the following expedient to obtain it: Long slips of bark are tied round the smooth stems of the pandanus, and the loose ends are led into the shells of the cockle (*Chama gigas*), placed underneath. By these slips, the rain which runs down the branches and stem of the tree, is conducted into the shells, and fills them at every considerable shower; and as each shell will contain two or three pints, forty or fifty thus placed under different trees will supply a good number of men. A pair of these cockle shells, bleached in the sun, weighed a hundred and one pounds; but still they were much inferior in size to some I have since seen."<sup>6</sup>

<sup>5</sup> It was suggested by Blainville (*Dict. Sci. Nat.*, lv., 1828, p. 256) that with advancing age the animal ceased to adhere to the rock and the byssal gape closed.

<sup>6</sup> Flinders—*Voy. Terr. Austr.*, ii., 1814, p. 114.

On Warrior Island, Torres Strait, Capt. Dumont D'Urville<sup>7</sup> saw in 1840, *Tridacna* shells used as water tanks, being set in pairs to catch the drip from Pandanus trees, as Flinders described. His illustration is here reproduced.

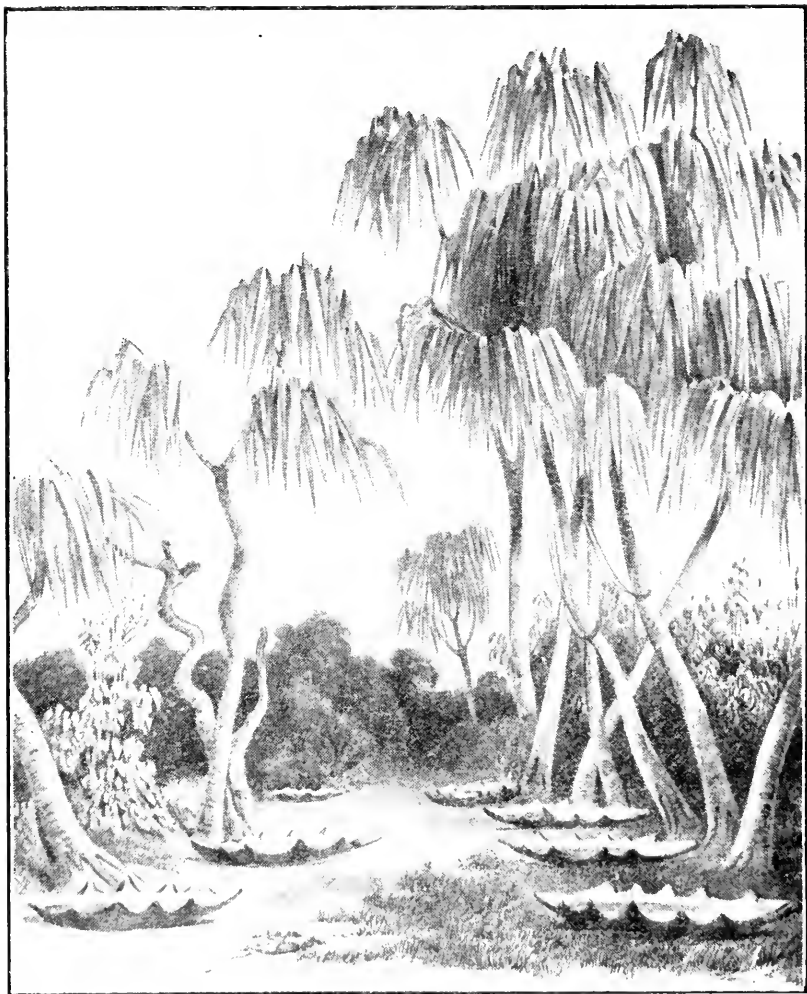


Figure 1. Giant clams set in pairs, serving as tanks, to catch the drip from Pandanus trees. Warrior Island, Torres Strait, 1840.

Specimens figured (PL. xxvii), were collected by myself on Green Island, off Cairns. One is 2 feet 3 inches long, the pedal gape has disappeared, and the lateral teeth, though still in existence, are comparatively light. The other is ten inches long and has a considerable pedal gape.

Dumont D'Urville. Voy. Pole Sud., ix, 1846, p. 235, pl. clxxxviii.



TRIDACNA MAXIMA, *Bolten*.

*Tridacna maxima*, Bolten, Mus. Bolt., 1798, p. 171 for Chemnitz, Conch. Cab., vii., 1784, p. 122, pl. xlix., fig. 495.

*Chama gigas*, var. B., Dillwyn, Descrip. Cat., i., 1817, p. 214; Encyclopedie meth., pl. cxxxv., fig. 1.

*Tridacna elongata*, Reeve, Conch. Icon., xiv., 1862, pl. ii., fig. 2a. *Id.*, Brazier, Mem. Austr. Mus., ii., 1889, p. 28. *Id.*, Melvill & Standen, Journ. Linn. Soc. Zool., xxvii., 1899, p. 189. *Id.*, Hedley, Mem. Austr. Mus., iii., 1899, p. 505. *Id.*, Hedley, Proc. Linn. Soc. N.S.Wales, xxxi., 1906, p. 465 (not *T. elongata*, Lamarek, 1819).

*Tridacna compressa*, Saville Kent, Great Barrier Reef, 1893, pp. 12, 26, 103, pls. iv. and xv. (clams in situ), Chromo pl. xiii., fig. 10 (colours of mantle margin). *Id.*, Banfield, The Confessions of a Beachcomber, 1908, p. 132.

*Tridacna scapha*, Sowerby, Thes. Conch., v., 1884, p. 181, pl. cccclxxxix., fig. 16.

Probably the type shell figured by Chemnitz of *T. maxima* is still preserved in the Copenhagen Museum.

## TRIDACNA MAXIMA, var. FOSSOR, var. NOV.

(Plate xxix., fig. 6, and Plate xxxiii., fig. 11).

A Clam from Queensland and Lord Howe Island apparently differs from typical *T. maxima* by the shortness of the dorsal-posterior end and it is also remarkable for the large pedal gape. The resilium is considerably submerged. Indeed, when more material is available for comparison, this may stand as an independent species. The type is a young shell (C. 18727) 80 mm. long, which I collected at Mast Head Island, Capricorn Group. A large and massive individual of the same species, 195 mm. in length, which I took at Lord Howe Island, is shown on Pl. xxix., fig. 6.

This variety marks the southern limit of the genus.

On a recent visit Mr. A. R. McCulloch found this *Tridacna* plentiful on the reef at Lord Howe Island. Specimens ranged from two to eight inches in length, those in unfavourable conditions being considerably distorted. Frequently the *Tridacna* excavated in dead coral rock a hole half an inch deep round the byssal anchor. The rubbed scales of the umbonal area indicate the depth attained. So variable is the colour and pattern of the mantle that no two animals seemed alike: they might be uniform dark chocolate or chocolate edged with green or have a paler ground with vivid blue or green markings.

He observed the *Tridacna* to suffer from the operations of a Sea Urchin, *Echinometra lucunter* which drives a burrow undermining and eventually dislodging the bivalve. Once loosened the *Tridacna* appeared to be unable to re-establish itself and was apt to be washed in to a sandy pool where it quickly perished.

TRIDACNA MUTICA, *Lamarck*.

*Tridacna mutica*, Lamarck, Anim. s. vert., vi., 1819, p. 106. *Id.*, Sowerby, Thes. Conch., v., 1884, p. 180, pl. cccclxxxv., fig. 1. *Id.*, Lamy, Bull. Mus. Hist. Nat., xii., 1906, p. 215 (not *T. mutica*, of Chenu, Quoy & Gaimard and other authors).

*Tridacna gigas*, Broderip, The Penny Cyclopædia, xxv., 1843, p. 207, text fig. *Id.*, Reeve, Conch. Icon., xiv., 1862, pl. i., fig. 1 (not *T. gigas*, Linné).

*Tridacna lamarecki*, Hidalgo, Mem. R. Acad. Cienc. Madrid, xxi., 1903, p. 385.

"*Benitiers*," Andran, Bull. Soc. d'Etudes Océaniques, No. 3, March, 1918, p. 128.

Hitherto unrecorded for Australia.

*Hab.*—Melbidir Bay, east coast Mornington Island, Gulf of Carpentaria, C. Hedley, 1903.

TRIDACNA SQUAMOSA, *Lamarck*.

(Plate xxviii., fig. 3).

*Tridacna squamosa*, Lamarck, Anim. s. vert., vi. (1), 1819, p. 106, Encycl. Meth., pl. cccxxvi., fig. 1 (not pl. cccxxv., fig. 4, *T. elongatissima*, Bianconi). *Id.*, Chenu, Illustr. Conch., Tridacna, 1845, p. 1, pl. iii. *Id.*, Cuvier, Regn. Anim., 3rd Ed., 1849, Moll., pl. xevi., fig. 1. *Id.*, Reeve, Conch. Icon., xiv., 1862, pls. iii., iv. *Id.*, Hedley, Mem. Austr. Mus., iii., 1899, p. 504. *Id.*, Melvill & Standen, Journ. Linn. Soc. Zool., xxvii., 1899, p. 190. *Id.*, Hidalgo, Mem. R. Acad. Cienc. Madrid, xxi., 1903, p. 386. *Id.*, Lynge, K. D. Vidensk. Selsk. Skr., vii. (3), 1909, p. 262. *Id.*, Hirase, Illustr. Thousand Shells, i., 1911, fig. 36. *Id.*, Odhner, Kongl. Sv. Vet. Akad. Handl., 52, 1917, p. 8.

*Chamaetrachuca squamosa*, Schmeltz, Cat. Mus. Godeffr., v., 1874, p. 172.

In *T. squamosa*, as shown in Cuvier's figure, the comb of the pedal orifice has more prominent teeth than in other species; this species is also more equilateral than usual. A specimen that I obtained on Murray Island, is thirteen inches long. Another specimen in the Museum Collection from the Gilbert Islands is one foot, two and a half inches long (37 centimetres), a size larger than any yet recorded.

*Hab.*—Broome, Western Australia (Mjöberg), Murray Island, Torres Straits (Haddon and Hedley).

## A PAPIAN SORCERY TUBE.

BY

W. W. FRODIP, Ethnologist, Australian Museum.

(Figure 1-2).

From His Excellency, Judge J. H. P. Murray, Lieutenant-Governor of Papua, the Trustees have just received as a donation, a small bamboo box, or tube (Fig. 1), used for the purpose of sorcery.

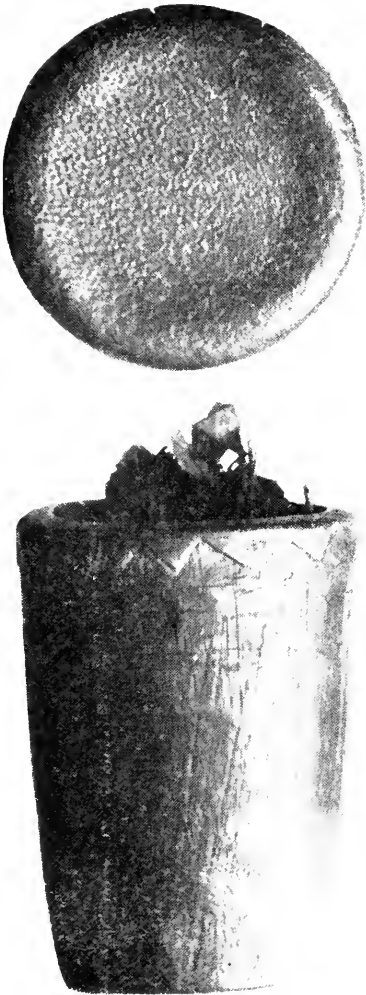


FIG. 2.

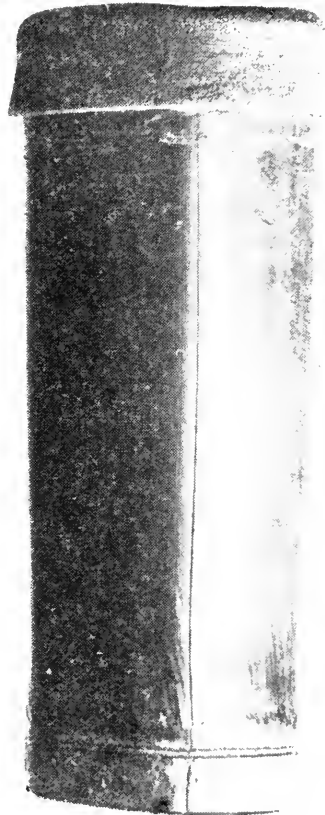


FIG. 1.

This receptacle, known as *ilu*, is from Modeva Village, on Suau, or Stacey Island, South Cape District, Eastern Division, Papua. The tube is an ordinary section of bamboo, with a length of  $4\frac{1}{4}$  inches and a diameter of  $1\frac{1}{2}$  inches, the internode forming the bottom, and capped by a rind lid. This latter has been identified by Mr. E. Cheel, of the Botanic Gardens, as the rind of a lime (*Citrus*). Some transverse scratches are added near the upper margin of the tube which may be scars produced when trimming the lid.

The tube is about one-third full of what appears to be vegetable mould, and, to obtain possession of the pigs, or women folk, of another native the owner follows this procedure:—"To use the charm you dip your finger in coconut water and then into the *ilu*. Then you pass your finger round your lips and proceed to ask the owner of the pig to give him to you. He will give him. The procedure with relation to women is analogous." It was represented to the donor as being a "very strong bottle," this description having reference to its potency for the purposes indicated. Here we have just the mere possession of a simple bamboo tube of mould, giving immediate command over the most valuable property of another. There does not appear to be any counter-charm against this practice.

For many years a somewhat similar object (Fig. 2) has been in the Museum, hitherto without any data other than "Scent Bottle, British New Guinea," and because of their similarity, the writer has taken the opportunity of figuring it with the specimen just described. It is of wood with a rind lid, but containing leaves. Around the upper margin is a series of raised triangles, and immediately below are some transverse scratches as noted on the first specimen. Dimensions:—Height,  $2\frac{1}{2}$  inches, inside diameter,  $1\frac{1}{2}$  inches, slightly tapering towards the base.

Very little seems to have been written regarding this form of sorcery in New Guinea. The only direct reference available is that of Bevan, who writes<sup>1</sup> of "little phials of bamboo containing liquids and solids," as part of the outfit of the Koitapuan sorcerer.

An official<sup>2</sup> writing his annual report records his opinion of the Papuan sorcerer as follows:—"The sorcerer, is without doubt, the greatest curse that Papua is possessed of, and, owing to the over-superstitious nature of the natives, is an influence for evil, wherever he exercises his functions." The same opinion has also been expressed by another official<sup>3</sup> in the Territory.

<sup>1</sup> Bevan (T. F., F.G.S.) *Tail, Travel and Discovery in British New Guinea*, London, 1890, p. 27.

<sup>2</sup> O'Malley (J. T.) *Papua, Annual Report for the Year ended 30th June, 1908*, p. 63.

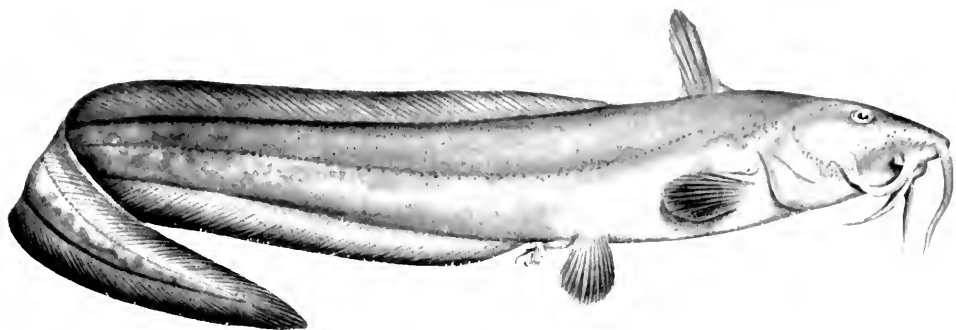
<sup>3</sup> Beaver (W.) *Ibid.*, p. 58.



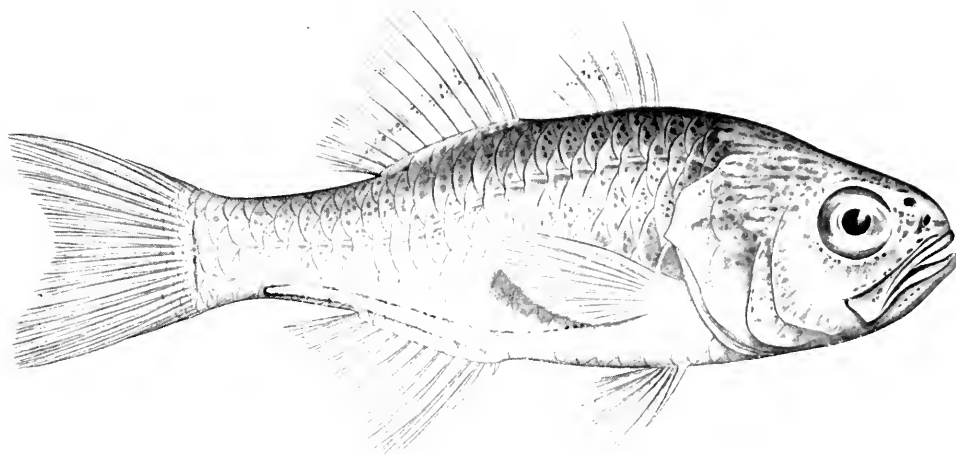
EXPLANATION OF PLATE XXI.

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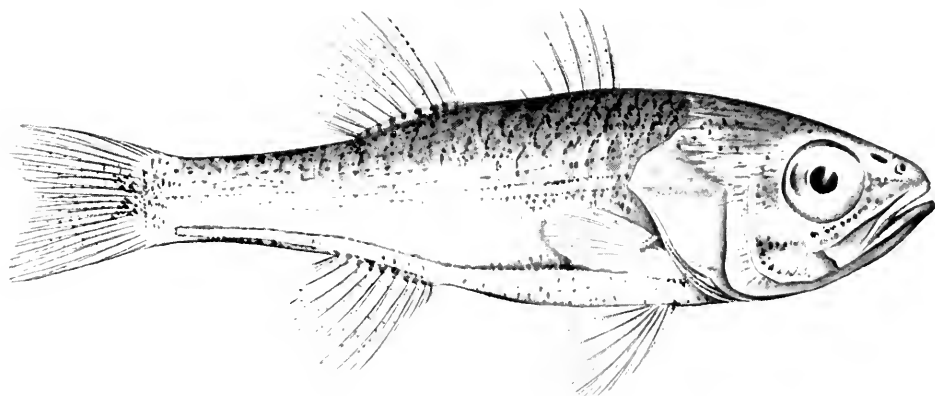
- Fig. 1. *Euristhmus lepturus*, Günther. A specimen 363 mm. long, from the Hawkesbury River estuary, New South Wales.
- „ 2. *Adenapogon roseipaster*, Ramsay & Ogilby. A specimen 62 mm. long, from the Clarence River estuary, New South Wales; the scales are drawn from a smaller specimen from the Parramatta River estuary.
- „ 3. *Adenapogon woodi*, McCulloch. Holotype, 44 mm. long, from Rose Bay, Port Jackson.



1



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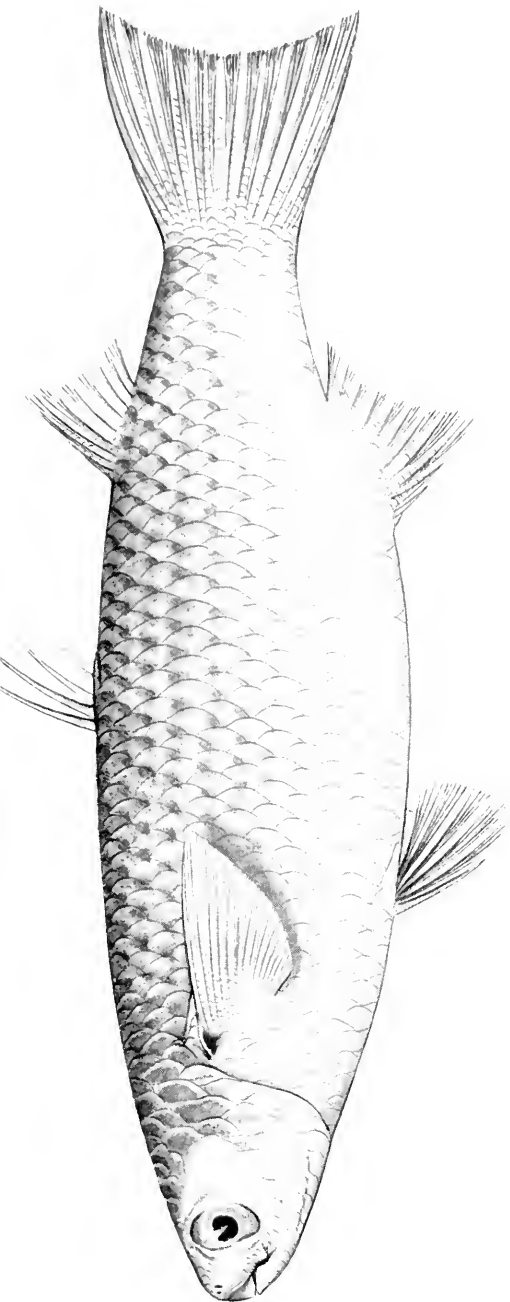




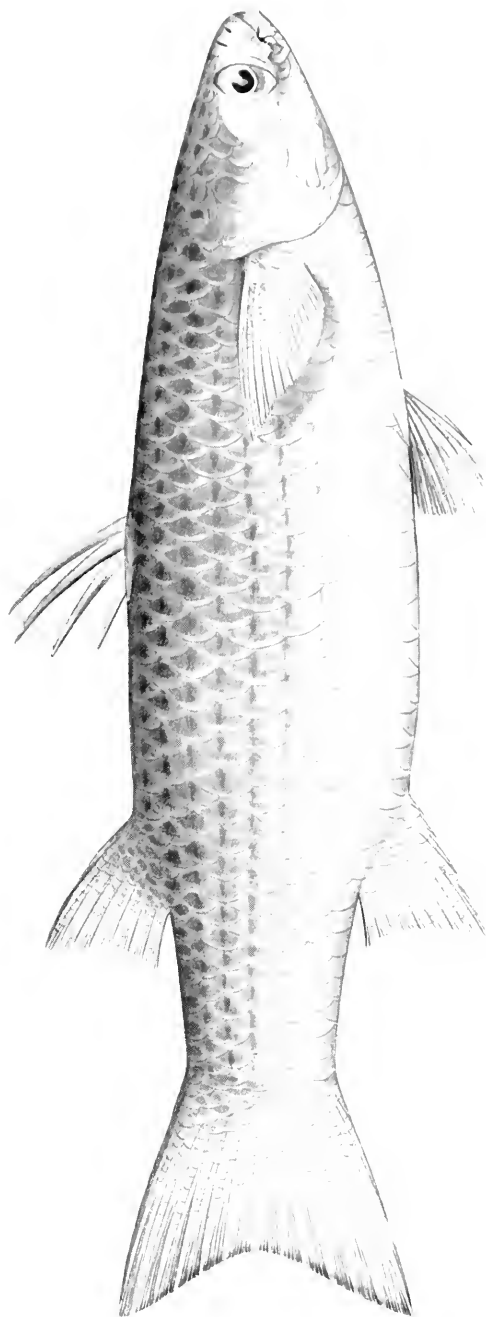
EXPLANATION OF PLATE XXII.

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- Fig. 1. *Mugil georgii*, Ogilby. A specimen 231 mm. long, from Port  
Hacking, New South Wales.
- „ 2. *Mugil tadopsis*, Ogilby. Type, 264 mm. long, from Moreton  
Bay, Queensland.



1



2

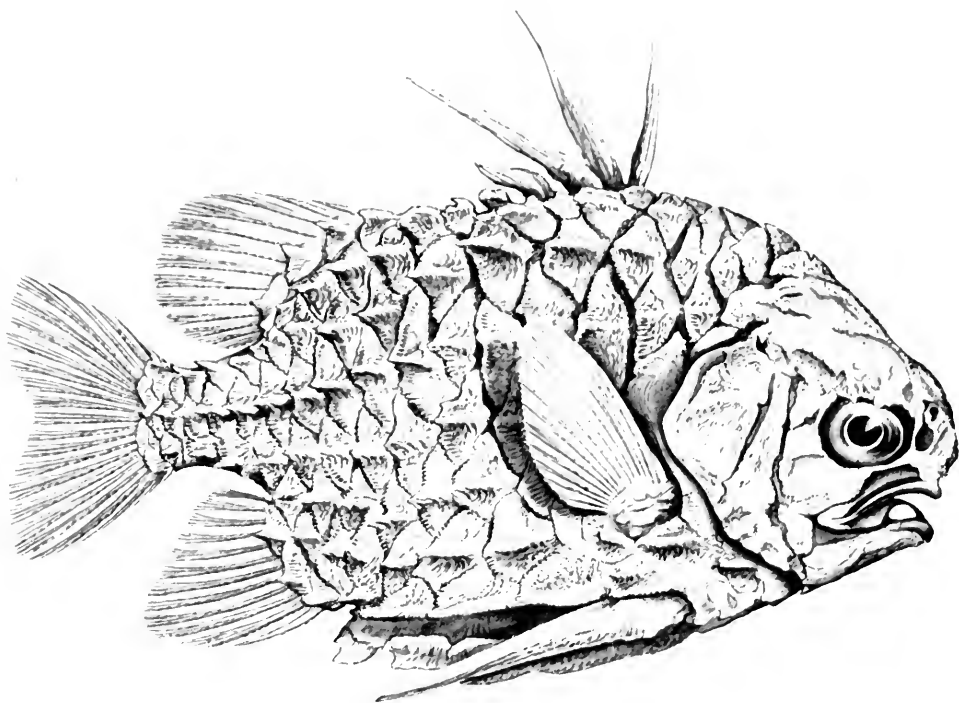




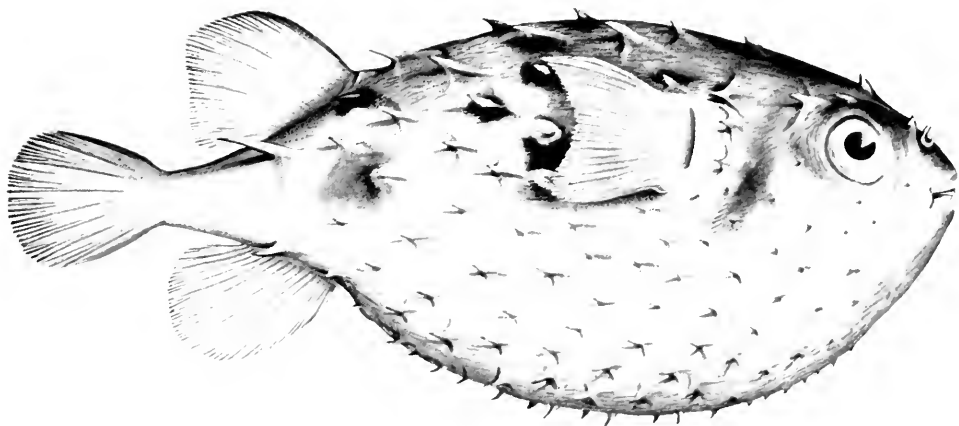
EXPLANATION OF PLATE XXIII.

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- Fig. 1. *Ulsidopus gloria-maris*, De Vis. A specimen 180 mm. long,  
from off Saddle Hill, New South Wales, 34-35 fathoms.
- .. 2. *Allomipterus jaculiferus*, Cuvier. A specimen 254 mm. long,  
from off Botany Bay, New South Wales.



1



2

A. R. McCulloch, del. (1).

Phyllis F. Clarke, del. (2).



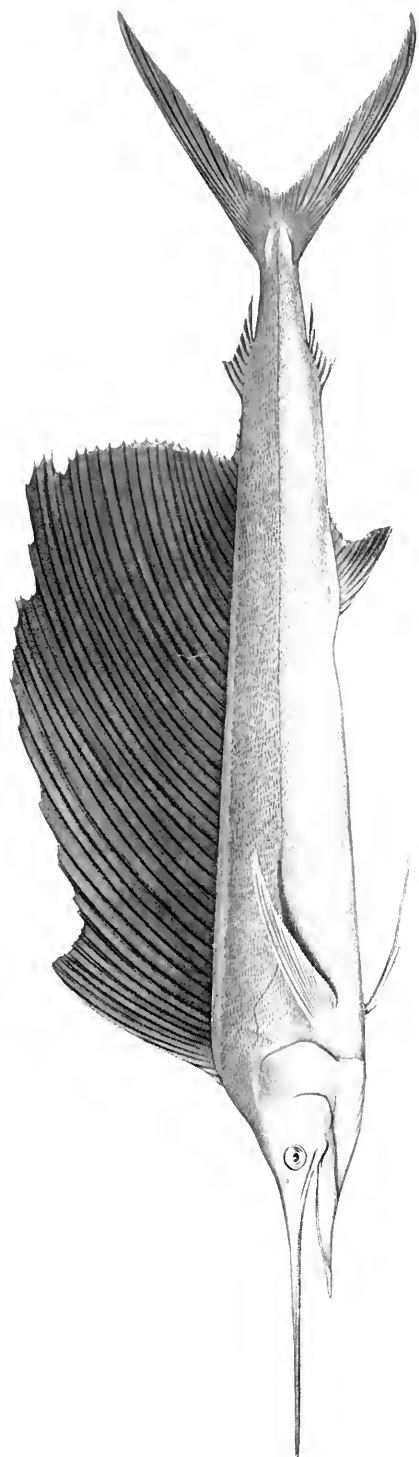




EXPLANATION OF PLATE XXIV.

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- Fig. 1. *Istiophorus gladius*, Bronssonet. A specimen 1570 mm. long from the end of the lower jaw to the tips of the middle caudal rays. Port Stephens, New South Wales. (Fide Mr. D. G. Stead).
- .. 2. *Thyrzites atna*, Euphrasen. A specimen 450 mm. long to the end of the middle caudal rays, from near Sydney.



1



2

A. R. McCulloch, del. (1).  
Phyllis F. Clarke, del. (2).

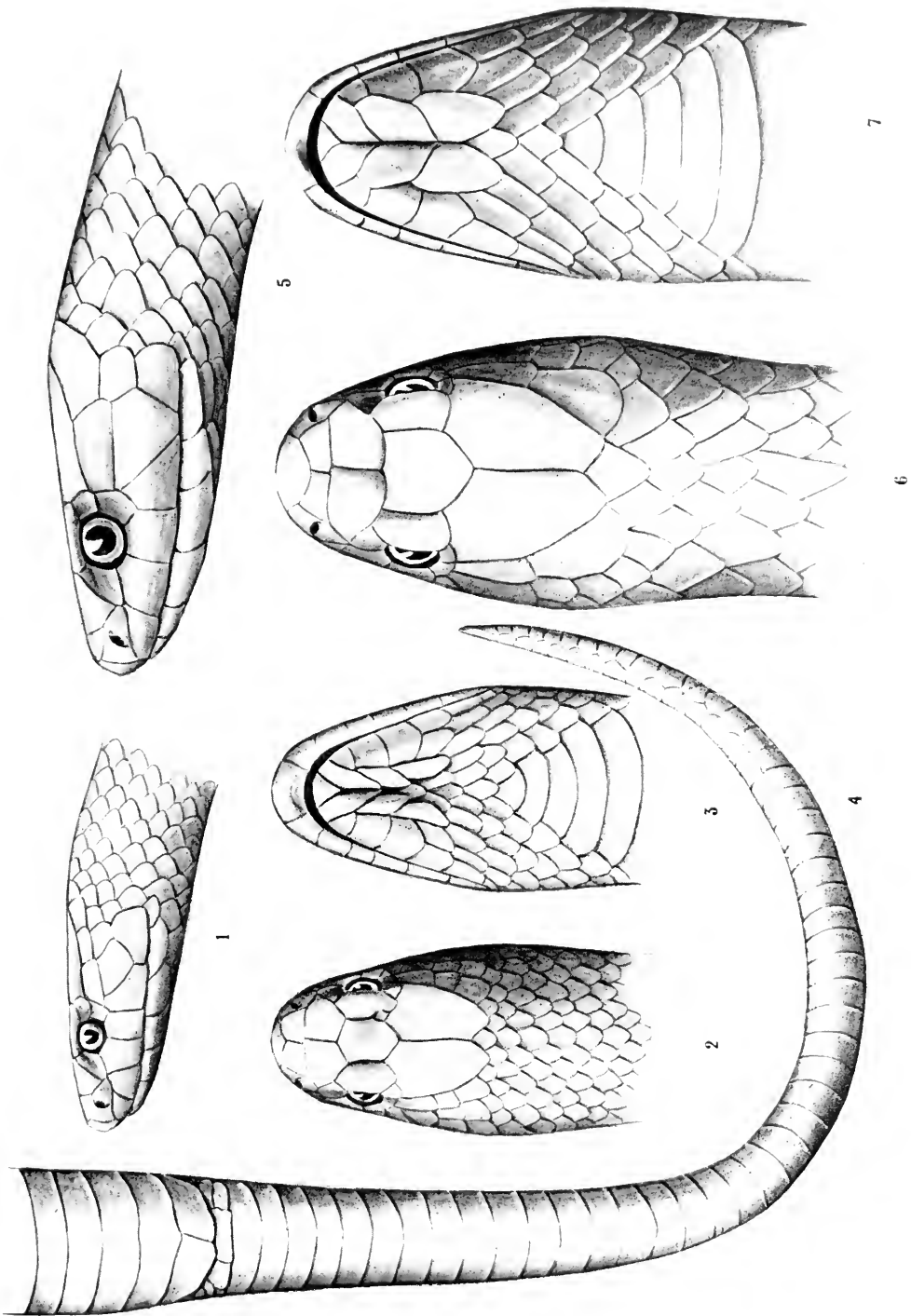




EXPLANATION OF PLATE XXV.

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- Figs. 1-4. *Pseudechis mortonensis*, De Vis. Drawn from the specimen from Willow Tree, New South Wales.
- „ 5-7. *Notechis ater*, Krefft. Drawn from the Holotype of *Hoplocephalus ater*, Krefft.





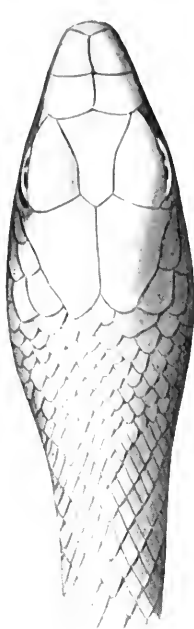




EXPLANATION OF PLATE XXVI.

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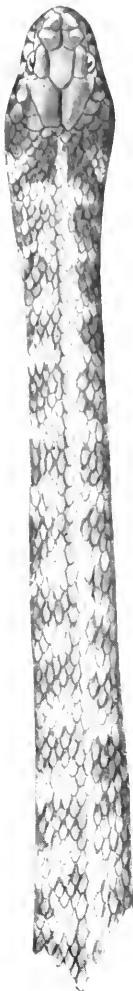
- Figs. 1-3. *Dendrophis calligaster*, Günther. Drawn from the Holotype  
of *Dendrolaphis schleckeri*, Ogilby.
- „ 4-5. *Denisonia maculata*, var. *derisi*, Waite and Longman. Drawn  
from a New South Wales specimen.
- „ 6-8. *Notochis scutatus*, var. *niger*, var. nov. Drawn from the  
Holotype. Kangaroo Island, South Australia.
- Fig. 6. *a* indicates the tip of the tail.



1



2



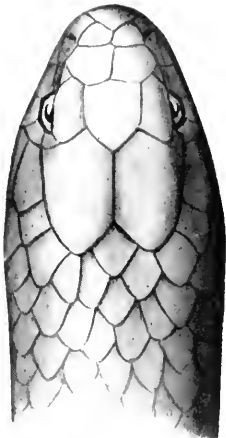
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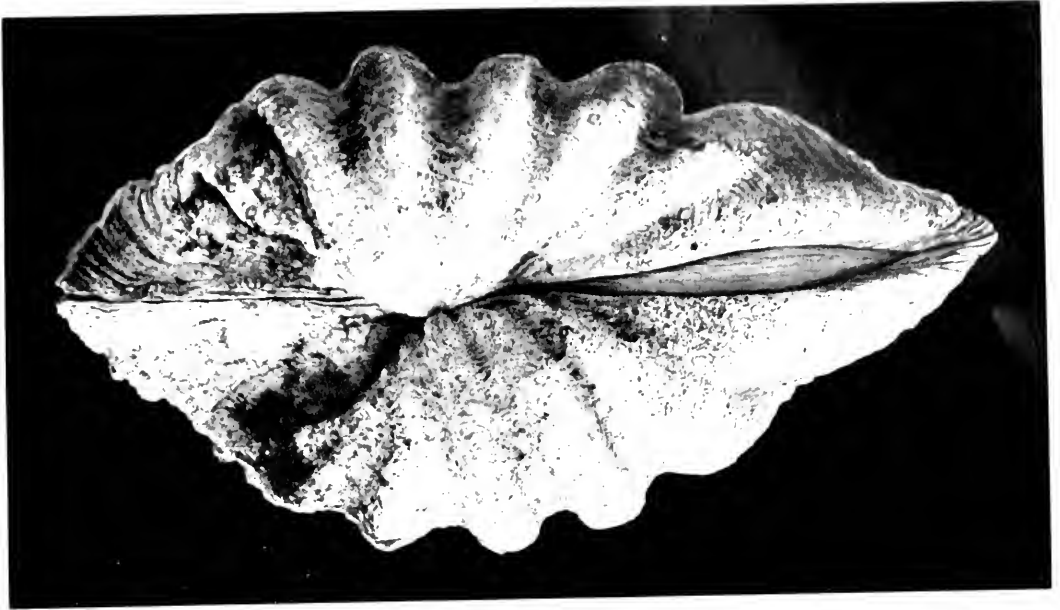




EXPLANATION OF PLATE XXVII.

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- Fig. 1. *Tridacna gigas* from a specimen 2 feet, 3 inches long, collected  
at Green Island, Queensland.
- „ 2. *T. gigas* from a specimen 10 inches long also from Green Island.



1



2



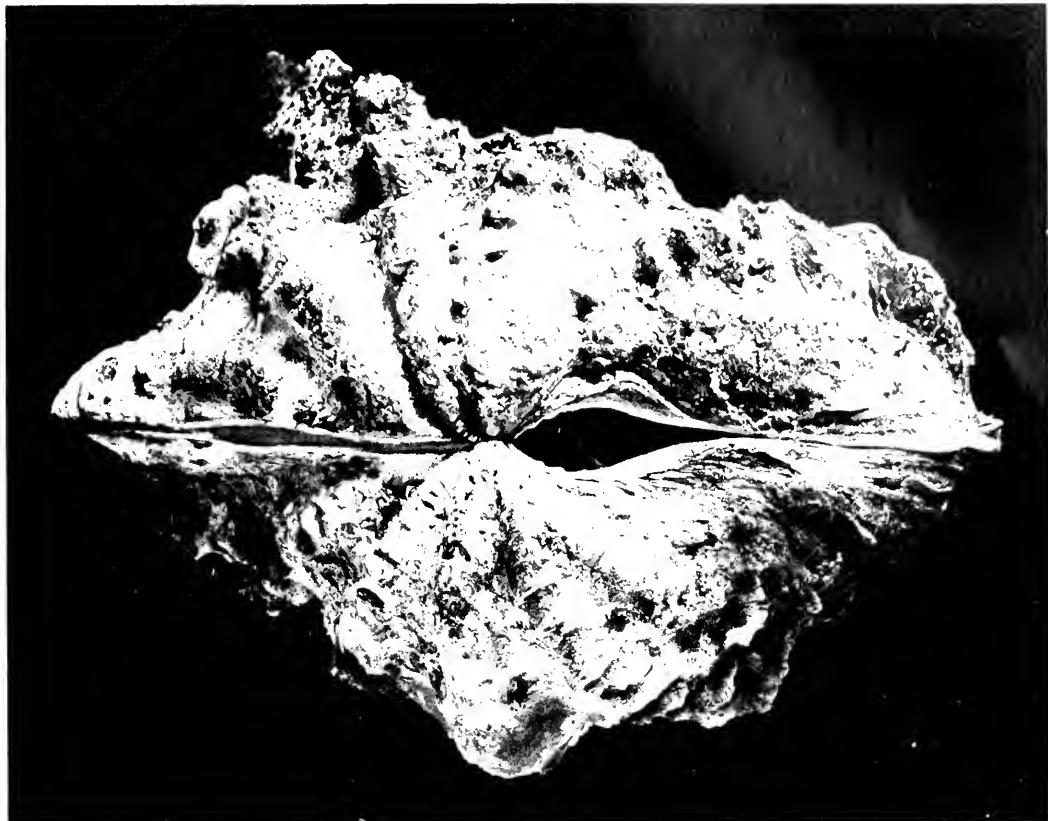




EXPLANATION OF PLATE XXVIII.

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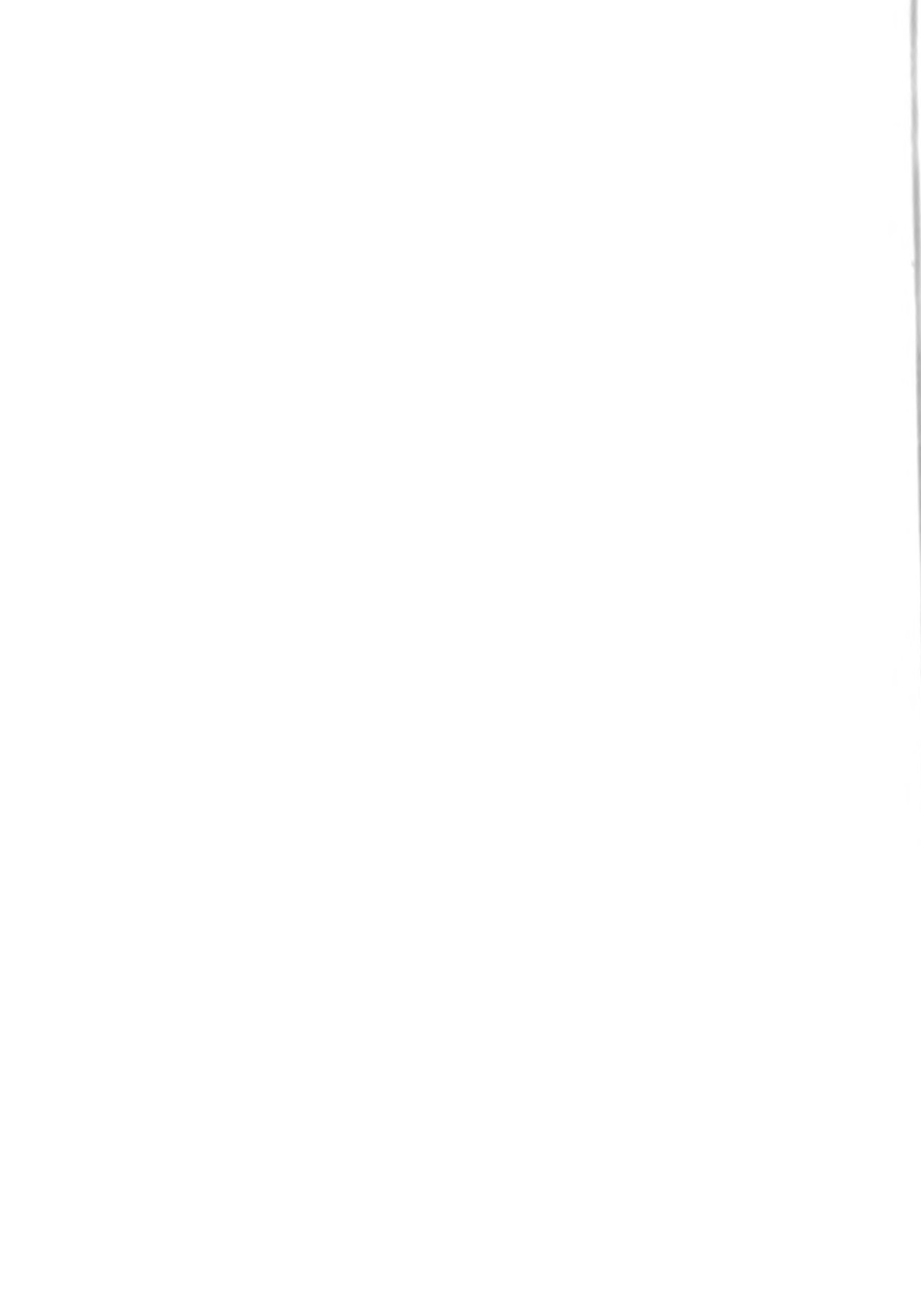
- Fig. 3. *T. squamosa*, Lamarek, from a specimen  $12\frac{1}{2}$  inches long, Murray Island, Torres Straits.
- „ 4. *T. derasa*, Bolten, a specimen 8 inches long, from Murray Island



3



4

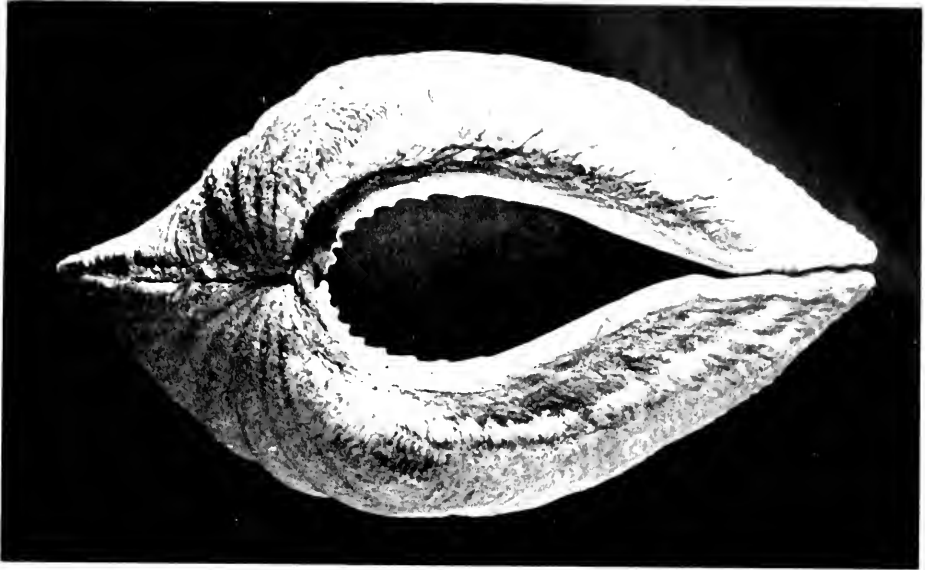




EXPLANATION OF PLATE XXIX.

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- Fig. 5. *T. crocea*, Lamarek, 4 inches long, Hope Island, Queensland.  
„ 6. *T. maxima*, Bolten, var. *fossor*, Hedley, a specimen  $7\frac{1}{2}$  inches long, from Lord Howe Island.



5



6







EXPLANATION OF PLATE XXX.

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Fig. 7. *T. maculosa* var. *fossor*, type,  $3\frac{1}{4}$  inches long, from Mast Head Island, Queensland.

„ 8. *T. elongata*, Lamarek,  $5\frac{1}{4}$  inches long, Sunday Island, W.A.



7



8





EXPLANATION OF PLATE XXVI.

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Fig. 9. Model of burrow of *T. crocea*, cut open to show the natural position of the shell and animal with extended mushroom shaped foot that excavates the cell.





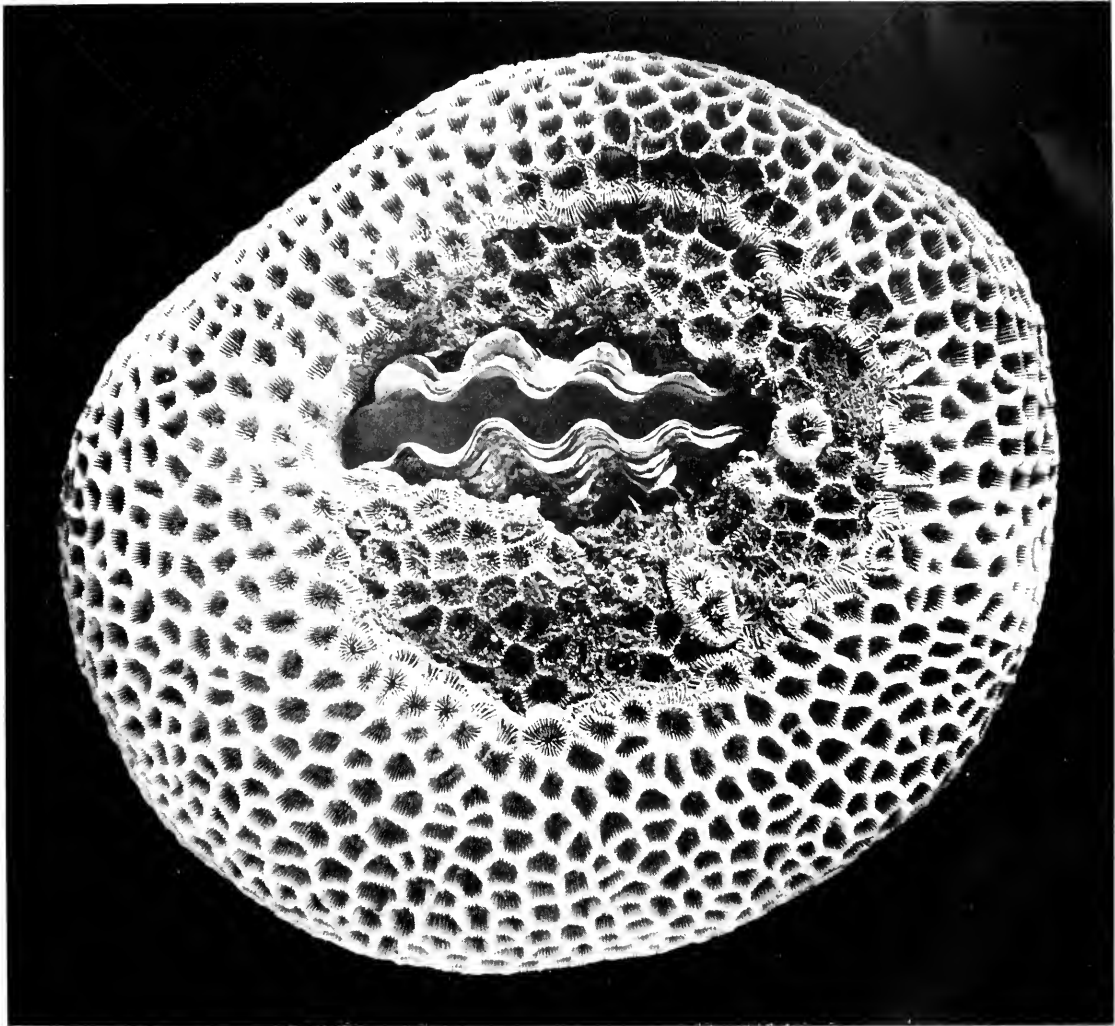




EXPLANATION OF PLATE XXXII.

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Fig. 10. Empty shell of *T. crevata* in block of Astrean coral, from Dunk Island, Queensland.







EXPLANATION OF PLATE XXXIII.

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- Fig. 11. Left valve, interior of *T. maxima* var. *fossor*, from Lord Howe Island, 195 mm. long.
- „ 12. Left valve, interior of *Cardita crassicosta*, Lamarck, from Anson Bay, Northern Territory, 75 mm. long, for comparison with Fig. 11.



11



12

*Phyllis T. Clarke*



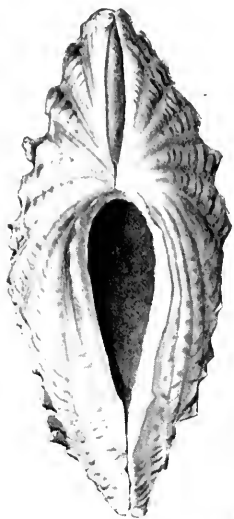




EXPLANATION OF PLATE XXXIV.

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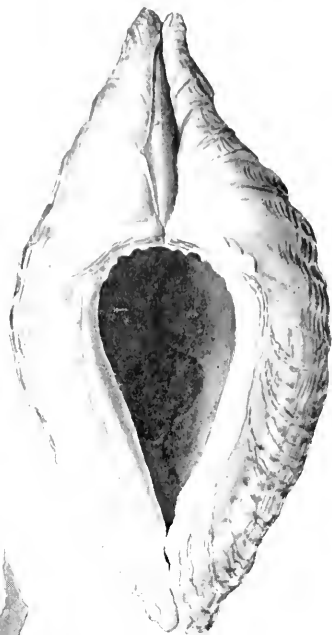
- Fig. 13. Young, *T. crocea*, Lamarck, 35 mm. long, commencing to burrow in dead coral.
- .. 14. *T. crocea*, 18 mm. long.
- .. 15. *T. crocea*, 31 mm. long, to show disproportionate increase of pedal aperture.
- .. 16. Right valve of *Tridacna*, 2·7 mm. high.
- .. 17. Hinge of ditto.
- .. 18. Left valve of *Tridacna*, 2·0 mm. high.
- .. 19. Hinge of ditto.



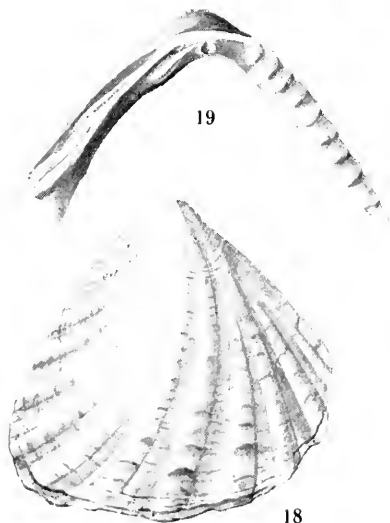
14



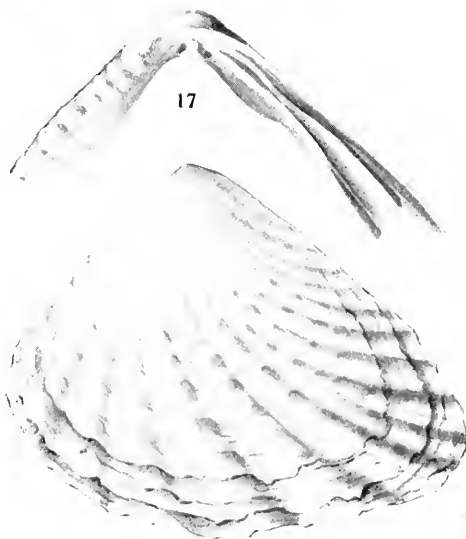
13



15



18



16

*Phyllis L. Clarke.*



# SARCOPHAGID FLIES IN THE AUSTRALIAN MUSEUM COLLECTION

BY

PROFESSOR T. HARVEY JOHNSTON, M.A., D.Sc.,

and

O. W. TIEGS, M.Sc., W. and E. Hall Fellow in Economic Biology,  
University, Brisbane.

(Plate xxxv., and Figures 1-2)

In a recent paper by us (1921) an attempt was made to determine the different species of Sarcophagid flies occurring in Southern Queensland by employing the characters of the copulatory organs in the male, a method first used by Böttcher for European species, and followed successfully by Parker and by Aldrich in dealing with North American forms. The present paper is a continuation of the work, some new Australian forms being described, while additional information is given regarding two known Hawaiian flies, and an account of a new Sarcophagid from New Zealand is included.

An examination of the specimens in the Australian Museum has enabled us to record a considerable extension of the known range of several species. The collection now includes, as far as we are aware, representatives of all adequately described Australian species except the following:—*Sarcophaga delta* J. and T., *S. bancrofti* J. and T., *S. omega* J. and T., as well as the following insufficiently described forms which we have not as yet been able to recognise:—*S. predatrix* Walker, *Sarcophagula pallichrus* Thomson, *S. pachytili* Skuse and *S. odipoda* Olliff.

*Sarcophaga predatrix* was named from a female specimen fly from Port Essington, Northern Territory. *Sarcophagula pallichrus* was described by Thomson as a *Sarcophaga*, his account being based on a female specimen collected in Sydney by the "Eugenie" expedition. Van der Wulp transferred it provisionally to the genus under which it is here listed.

*Sarcophaga pachytili*, a parasite of Australian grasshoppers, was described by Skuse as a *Masicera*, but Coquillet regarded it as a *Sarcophaga* and referred to it as such in a paper<sup>1</sup> dealing with two American grasshopper parasites, *S. opifera* and *S. davidsoni*. *S. opifera* was made the type of a new genus *Opsophyto* by Townsend,<sup>2</sup> but Aldrich in his monograph of the North American Sarcophagidae does not recognise the genus. Skuse's figure suggests a Tachinid.

*Sarcophaga odipoda* is a *nomen nudum*, the mere name *Tachina odipoda* having been used by Olliff for a fly bred from N. S. Wales grasshoppers. Mr. Froggatt<sup>3</sup> in his work on Australian insects stated that Coquillet

<sup>1</sup> Coquillet—U. S. Dept. Agric., Insect Life, v., 1. 1892, p. 22.

<sup>2</sup> Townsend—Proc. Biol. Soc. Washington, xxviii., 1915, p. 23.

<sup>3</sup> Froggatt—Australian Insects, 1907, p. 315.

considered it to be a *Sarcophaga*, and in one of his own papers<sup>4</sup> mentioned that it closely resembled *S. aurifrons*, but possessed a less golden colouration of the head and thorax. In a subsequent article on the "Eastern plague locust"<sup>5</sup> he referred to *Masicera pachytili*, and to a second dipterous parasite, *S. aurifrons*, from which one may infer that he was satisfied as to the synonymy of *S. edipoda* with Macquart's species. In view of this, together with the lack of any account by Olliff, we may safely remove *S. edipoda* from the list of Australian Sarcophagidæ.

In our previous paper we attempted to clear up the confusion which existed in the synonymy of these Australian flesh-flies, but one important publication, that of Robineau-Desvoidy,<sup>6</sup> was not at the time available. Through the kindness of Mr. C. T. Greene, U. S. National Museum, Washington D.C., this deficiency has been remedied, and has enabled us to reduce the synonymy even more.

The opportunity is also taken to correct some minor errors in our previous paper.

We desire to express to the Trustees of the Australian Museum our appreciation of their kindness in permitting us to examine the Sarcophagidæ contained in the Museum.

### 1. *Helicobia australis* Johnston and Tiegs.

*Helicobia australis* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 50.

One male, paratype, Brisbane, Queensland.

### 2. *Sarcophaga impatiens* Walker.

*S. impatiens* Walker, List. Dipt. British Mus., 1849, iv., p. 828.

*S. impatiens* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 52.

Several males and females, Brisbane, Queensland.

### 3. *Sarcophaga tryoni* Johnston and Tiegs.

*S. tryoni* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 54.

*S. frontalis* (in part) of Australian authors.

Two males and a female, paratypes, Brisbane, Queensland.

In our original description of this insect we stated: "Prescutellar acrostichals extend almost to end of scutellum," and "anterior femora . . . not hairy." This should be amended to read as follows: "Prescutellar acrostichals absent; anterior femora . . . scantily clad with long hairs."

<sup>4</sup> Froggatt—Agric. Gazette, N.S.W., xvi., 1905, p. 20.

<sup>5</sup> Froggatt—loc. cit., xviii., 1907.

<sup>6</sup> Robineau-Desvoidy—Essai sur les Myodaires, 1830.

4. *Sarcophaga alpha* Johnston and Tiegs.

*S. alpha* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 57.

One male, paratype, from Brisbane, Queensland.

5. *Sarcophaga beta* Johnston and Tiegs.

*S. beta* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 58.

One female, paratype, from Brisbane, Queensland.

6. *Sarcophaga peregrina* R.D.

*Myophora peregrina* Robineau-Desvoidy, Essai sur les Myodaires, 1830, p. 356.

*Myophora subrotunda* R.D., l.c., p. 357.

*Myophora rapida* R.D., l.c., p. 360.

*Sarcophaga tritonia* Macquart, Dipt. Exot. Suppl., iv., 1850, p. 234.

*S. irrequieta* Walker, List. Dipt. British Mus., 1849, iv., p. 830.

*S. ochripalpis* Thomson, Eugenes Resa, Diptera, 1868, p. 537.

*S. frontalis* Johnston and Bancroft, Proc. Roy. Soc. Queensland, xxxii., 1920, p. 23.

*S. irrequieta* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 63.

This is by far the commonest sarcophagid fly in South Eastern Queensland. Mr. A. P. Dodd informs us that it likewise predominates in the Cairns district, North Queensland. The Australian Museum specimens are chiefly from Sydney, but there are also a few from the Fly River, New Guinea.

It is but natural that the various entomologists who described our Sarcophagids, from Robineau-Desvoidy onwards, should have come across this insect, and as they gave little or no attention to each other's work, it is not surprising that a considerable synonymy has arisen. Furthermore, as the general body colour of the fly may vary considerably from pale golden to pure silvery, the confusion has become still greater. However, as this insect is easily recognised even without an examination of the male copulatory organs, we have no hesitation in giving the above synonymy. The differences on which the species referred to are founded are not greater than the amount of variation often seen in the offspring of a single parent, both in regard to size and colouration, while the sex differences are well enough defined to account for any apparent discrepancies in early descriptions.

That *S. tritonia* Macquart, is synonymous with *S. peregrina* is almost certain. The fly was described from Triton Bay, Dutch New Guinea, but as the brief description in every way fits *S. peregrina*, and since we have

examined specimens of the latter species from British New Guinea, we are suggesting the synonymy, hoping thereby to reduce the confusion which the ambiguous accounts of early entomologists have produced.

7. *Sarcophaga eta* Johnston and Tiegs.

*S. eta* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 65.

One male, paratype, bred from decaying fish, Brisbane, Queensland.

8. *Sarcophaga misera* Walker.

*S. misera* Walker, List. Dipt. British Museum, iv., 1849, p. 829.

*S. frontalis* Thomson, Eugenes Resa. Diptera., 1868, p. 535.

*S. frontalis* (in part) Froggatt, Australian Insects, 1907, p. 314-5.

*S. frontalis* Tryon, Dept. Agric. Qld. Ann. Rep. 1916-7 (1917), p. 53.

*S. misera* Cleland, Aus. Med. Congress, 1911 (1913), pp. 548, 570.

*S. misera* Johnston and Bancroft, Proc. Roy. Soc. Queensland, xxxii., 1920, p. 23.

*S. misera* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 67.

A male from Victoria, a female from Sydney, New South Wales. The presence of fairly well-developed presentellar acrostichal bristles should have been mentioned in our earlier account.

9. *Sarcophaga misera* var. *dux* Thomson.

*S. dux* Thomson, Eugenes Resa. Dipt., 1868.

*S. subtuberosa* Parker, Proc. U.S. Nat. Mus., liv., 1917, p. 89.

*S. misera* var. *dux* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 70.

One male, Brisbane, Queensland. A species (or variety) widely distributed throughout the Pacific.

10. *Sarcophaga aurifrons* Macquart.

*S. aurifrons* Macquart, Dipt. Exot. Supp., i., 1846, p. 191.

*S. aurifera* Brauer and Bergenstamm, Denkschr. Akad. Wiss. Wien., 1891.

*S. aurifrons* Tryon, Dept. Agric. Qld. Ann. Rep., 1916-17, p. 53.

*S. aurifrons* Froggatt, Agric. Gazette, N.S.W., xvi., 1905, p. 20.

*S. aurifrons* Froggatt, Austr. Insects, 1907, p. 315.

*S. aurifrons* Froggatt, N.S.W. Dept. Agric. Farmers' Bull. 95, 1915, p. 29.

*S. aurifrons* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 71.

A male and a female from Brisbane, Queensland.



11. *Sarcophaga froggatti* Taylor.

*S. froggatti* Taylor, Bull. Ent. Res., vii., 3, 1917, p. 265.

*S. knabi* Parker, Proc. U. S. Nat. Mus., liv., 1917, p. 96.

*S. aurifrons* (in part) of Australian authors.

*S. froggatti* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 73.

*Glaucosarcophaga knabi* Townsend, Proc. Biol. Soc. Washington, xxx., 1917 p. 191 (type of genus).

*Glaucosarcophaga froggatti* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 76.

One male, Brisbane, Queensland.

12. *Sarcophaga theta* Johnston and Tiegs.

*S. theta* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 78.

A male and a female, paratypes, Brisbane, Queensland.

13. *Sarcophaga depressa* R.D.

(Plate xxv., fig. 4.)

*Myophora depressa* Robineau-Desvoidy, Essai Myodaires, 1830, p. 353.

*Myophora musca* R.D., l.c., 1830, p. 360.

*Sarcophaga flavifemorata* Macquart, Dipt. Exot. Suppl. 4, 1850, p. 233.

*Sarcophaga iota* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 79.

The specimens in the Australian Museum comprise four males and three females, captured at such widely separated localities as King George's Sound (S. W. Australia), Bagdad (Tasmania), Perth (W. A.), and Sydney (N.S.W.). It is quite common about Brisbane. As this is one of the commonest of the smaller golden sarcophagids, it is very probable that Robineau-Desvoidy had this species before him when he described *M. depressa*. The individual variations exhibited by this fly are sufficient to account for his describing it under two different names. As both his types were females, an examination of these, if they are still in existence, would be of little value, the female of this species being indistinguishable in external characters from the females of certain closely allied species. By adopting the above synonymy, the confusion resulting from the brief, more or less, general descriptions of early workers should be still further diminished. Macquart doubtless had this same species before him when he described *S. flavifemorata* from the east coast of Australia. As all the descriptions, as far as they go, apply to *S. iota*, recently described by us, and as this is the commonest small golden species in Australia, the synonymy as given above is probably correct. We give a figure of the terminal portion of the male genitalia.

14. *Sarcophaga kappa* Johnston and Tiegs.

*S. kappa* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 81.

One male, captured in Sydney, New South Wales.

15. *Sarcophaga omikron* Johnston and Tiegs.

*S. omikron* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 82.

One male, captured at Chinchilla, West Queensland, September, 1921.

16. *Sarcophaga sigma* Johnston and Tiegs.

*S. sigma* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 84.

A male and a female, paratypes, bred in Brisbane, Queensland, from decaying meat.

17. *Sarcophaga gamma* Johnston and Tiegs.

*S. gamma* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 60.

One male, paratype, caught on decomposing meat, Brisbane, Queensland, April, 1921.

18. *Sarcophaga zeta* Johnston and Tiegs.

*S. zeta* Johnston and Tiegs, Proc. Roy. Soc. Queensland, xxxiii., 1921, p. 76.

One male, bred from decomposing meat, Brisbane, Queensland, October, 1921.

19. *Sarcophaga epsilon* n. sp.

(Plate xxxv., fig. 1.)

A rather large fly, about 14 mm. in length; in general appearance golden and black.

## MALE.

*Head*.—Front prominent, at its narrowest slightly over half the eye-width; frontal stripe very dark brown, about as wide as parafrontals. The latter bright gold, with dark reflections; genæ similarly coloured. Eyes dark red brown. Mesofacial plates pale golden, with silvery pubescence, borders darker; back of head golden. First antennal joint distinctly visible, but not very large; second joint large, black; third joint black, and thrice the length of second. Arista nearly half as long again as the three antennal joints combined.

Vibrissæ inserted well above oral margin; about fifteen facial bristles present; eight epistomials. A row of thirteen frontal bristles on either side of frontal stripe. Verticals large; lateral verticals fairly well developed. A single row of black bristles behind eyes; back of head covered with short golden hairs, which develop into a beard-like growth below; bristles on front part of cheeks short and black.

*Thorax* ashy-golden, with the usual three longitudinal black stripes, the outer two broader than the middle stripe. On either side of the middle stripe are a pair of narrow but very distinct stripes, gradually fading away on the posterior part of the thorax; external to the outer stripes occurs on each side on the posterior half of the thorax a longitudinal black marking. Scutellum very dark, nearly black, with golden borders. Anterior spiracle pale brown, covered with white hairs. Sides of thorax golden; lower surface grey. Only the posterior pair of the anterior acrostichals are developed; of the posterior set only the last two pairs are present; all are very feebly developed. Dorsocentral row normal. Three pairs of humerals present; two intra-alars. Scutellar apicals present.

*Legs* black and grey. First femur faintly tinged with gold ventrally. Longitudinal rows of bristles complete; provided ventrally with a rather thick growth of short hairs; tibia not hairy. Second femur very faintly tinged with gold; not hairy; a distinct "comb" present. Third femur grey; both femur and tibia hairless.

*Abdomen* silvery and black, as usual; covered dorsally with short black reclinate bristles; hairy ventrally. Hypopygium very dark brown, nearly black, hairy. Forceps shiny black and sharply pointed, very hairy. Anterior third of each closely approximated. Claspers very dark brown; anterior rather blunt; posterior sharp. The penis resembles that of *Sarcophaga beta*. The chitinisation is very heavy, the whole structure being quite black. Ventrally it is developed into a forwardly bent hook, which acts as a protection for a pair of curved chitinous processes, very similar to those of *S. alpha*.

Described from one male, captured by us around decaying meat in Brisbane, Queensland, July, 1921.

## 20. *Sarcophaga hardyi* n. sp.

(Plate xxxv., fig. 5.)

In general appearance a rather large golden and black insect, measuring 12 mm. in length.

### MALE.

*Head*.—Frons rather prominent, half the width of eye; parafrontals pale golden in colour and provided with two very irregular rows of short black bristles; genæ and occiput a somewhat deeper gold. Frontal stripe brown, faintly silvery pollinose, and slightly wider than the parafrontals. First antennal joint fairly conspicuous; second slightly smaller than usual; third thrice the length of second, very dark brown and very strongly silvery pollinose. Arista over half as long again as the three

antennal joints combined. A single row of short black bristles behind eyes. Occiput covered with short golden hairs, developed into a beard-like growth below, but shortening again on the anterior part of the genae. A row of twelve frontal bristles on either side of frontal stripe. Verticals well developed; lateral verticals small. Vibrissae inserted well above oral margin. About nine facial bristles present; an irregular row of nine extending from these along the borders of the mesofacial plate, just internal to the ptilinal suture, about half-way towards the insertion of the antennae. Proboscis brown, in places nearly black; palps dark brown.

*Thorax* slightly narrower than head, golden with three longitudinal black stripes, the lateral pair curved faintly outwards and considerably wider than usual. The middle line extends very definitely on to scutellum; the laterals do not, but a short black mark on the posterior outer margin of the scutum is continued on to the scutellum. Microchaetae on thorax, especially on scutellum very strongly developed.

Of the anterior aerostichals only the last two pairs are differentiated, and are considerably larger than usual. Of the posterior set, only the prescutellar are developed; they extend over two-thirds the way to the posterior border of the scutellum. Row of dorsocentrals very well developed. Three humerals and three intra-alars present. Apical scutellars present. Anterior spiracle black with dark chocolate hairs. Sides of thorax grey, tinged with gold, very hairy. Ventral side grey.

*Legs* grey and black. First femur faintly tinged with gold. The longitudinal rows of bristles very complete; under side scantily clothed with long hairs; tibia slightly shorter than femur, and not hairy. Second femur slightly hairy on its proximal ventral half; "comb" very well differentiated; tibia a little shorter than femur and not hairy. Third femur and tibia hairy.

*Abdomen* provided dorsally with short reclinate bristles; hairy ventrally. Hypopygium black and very hairy. Forceps shiny black, the termination slightly hooked and sharply pointed; hairy almost to tips, the growth becoming very dense on the upper two-thirds. The penis is a rather complex structure; the distal joint is divided into an anterior and posterior portion, each provided with curious processes as figured. The nature of the claspers could not be observed in the specimen available.

#### FEMALE.

This differs from the male in the following characters:—It is rather smaller, measuring about 10 mm. in length. Frons a little wider than eyes. Frontal stripe about as broad as parafrontals. Frontal bristles arranged in an inner row of nine beside frontal stripe, and three above, just internal to eyes. Lateral verticals very prominent. Apical scutellars absent. Second femur not markedly hairy, "comb" absent. Third femur and tibia entirely devoid of hair.

Described from a male and a female collected by Mr. G. H. Hardy at Lannceston, Tasmania, in October, 1916.

21. *Sarcophaga littoralis* n. sp.

(Plate xxxv., fig. 2.)

In general appearance a medium-sized greyish fly, measuring some 10-11 mm. in length.

## MALE.

*Head*.—Frons fairly prominent, about three-fifths the width of eyes. Frontal stripe dark brown, about half as broad again as parafrontals, the latter silvery, faintly tinged with gold and with dark reflections; genae pale brownish yellow; occiput silvery, faintly tinged with golden. Eleven frontals beside frontal stripe; verticals smaller than usual, lateral verticals absent. Vibrissae small; seven very short, stout epistomials, and seven similar facials. These bristles are considerably stouter than any hitherto seen by us in Australian sarcophagids. A single row of short black bristles behind eyes; occiput covered with short silvery hairs which lengthen below, but become shorter again and more sparse on the anterior part of the genae. Eyes red brown, about three-fifths the height of head. First antennal joint conspicuous; second black, and smaller than usual; third about two and a half times the length of second, and of a fawn colour. Mesofacial plate very pale golden, with darker borders. Ptilinal suture remains fairly distinct throughout life.

*Thorax* grey; the middle longitudinal black line consists of three longitudinal portions anteriorly; posteriorly it is continued as a long narrow line, broadening out a little on the scutellum. Lateral lines irregular and not extending on to scutellum. Lateral and vertical regions of thorax grey; scutellum much abbreviated. Of the acrostichals, only the posterior pair of the anterior set is differentiated. Apical scutellars present. Dorsocentral row as usual. Two intra-alars and three humerals present.

*Legs* black, femora greyish. First femur not distinctly hairy; tibia hairless. Second femur lightly hairy; a "comb" differentiated; tibia hairless. Third femur lightly hairy; tibia hairless.

*Abdomen* black with greyish tessellations, the whole rather darker than usual. Abdomen covered dorsally with short reclinate bristles; hairy ventrally. Hypopygium black and hairy. Forceps black, hairy, and very distinctly humped, the upper halves closely approximated, the lower widely apart. Claspers simple, and rather slender. The distal joint of the penis is heavily chitinated, and of a rather complex structure.

## FEMALE.

This closely resembles the male, but differs in the following characters:—Frons as wide as eyes; eyes four-sevenths the height of head. Vertical bristles present. Frontal stripe a little wider than parafrontals. The epistomials, facials and vibrissae even more abbreviated than in male. Scutellar apicals absent. First femur very lightly hairy; second devoid of comb; third femur lightly clothed with golden hairs, tibia hairless.

Described from a male and a female captured on the ocean beach at Caloundra, South Queensland, August, 1921.

22. *Sarcophaga pullinervis* Thomson.

(Plate xxxv., fig. 6).

## MALE.

*Head*.—Frons not very prominent, measuring about two-fifths the width of eyes. Frontal stripe brown, about thrice the width of parafrontals. Parafrontals, occiput, and genæ silvery, with brown reflections. First antennal joint not very conspicuous; second black, tipped with brown; third only half as long again as second, dark brown and silvery pollinose. Mesofacial plate silvery, with dark borders. Vibrissæ inserted well above oral margin. Four facial bristles present, three others extending from these upwards half-way towards the antennal insertion. About thirteen well-developed epistomials present. A row of ten frontals beside the frontal stripe. Three distinct rows of bristles on back of head. Bristles on genæ black. Verticals very well developed, lateral verticals very weak. Thorax rather narrower than head, grey, with the usual three longitudinal black lines. Sides grey with a few black markings, ventral side grey. Scutellum grey. Anterior acrostichals very well developed; of the posterior set only the prescutellar pair sharply differentiated. Dorsocentral row complete. Apical scutellars absent. Three humerals present. Anterior spiracle provided with numerous white hairs.

*Legs* black. First femur slightly hairy; tibia devoid of hair. Second femur slightly hairy proximo-ventrally; distally a "comb" developed. Third femur only very slightly hairy proximally; tibia hairless.

*Abdomen* clothed dorsally with short reclinate bristles; ventral side less hairy than usual. Hypopygium pale reddish brown, slightly bristly. Forceps brown, hairy almost to tips, not curved. Claspers brown. The penis is a rather simple structure, very dark brown in colour, and the distal joint produced downwards into two short blunt bosses, while anteriorly it gives off a pair of short processes.

## FEMALE.

This differs from the male in the following characters:—Frons slightly broader than eyes. Frontal stripe almost twice the breadth of parafrontals. A row of eight frontals beside frontal stripe, four others beside the eye. Thoracic chaetotaxy as in male. Second femur devoid of "comb." Third femur and tibia hairless.

Described from several males and females donated by Mr. H. Tryon, Government Entomologist, Queensland, bred in Oahu, Hawaii, from cow manure.

23. *Sarcophaga hemorrhoidalis* Fallen.

(Plate xxxv., fig. 3.)

## MALE.

In general appearance a rather large greyish fly, measuring nearly 14 mm. in length.

*Head*.—Frons not very prominent, a little over half the width of eyes. Frontal stripe exceedingly broad, black, and measuring about thrice the width of the parafrontals. Parafrontals, occiput, and genæ dark grey. Eyes red-brown, about three-fifths the height of head. First

antennal joint inconspicuous; second normal, rather black in colour; third joint over twice the length of second, dark brown, and silvery pollinose. Arista brown, a little longer than the three antennal joints combined. Vibrissa inserted well above oral margin. Mesofacial plate brown. Seven large and four small facial bristles present; about ten epistomials present. A row of eleven frontal bristles beside frontal stripe. Verticals rather small; lateral verticals not very strongly developed. Three rows of black bristles behind eyes, of which only the first is well developed. Occiput clothed with short silvery hairs, developing into a beard-like growth below; anterior part of genæ clad with short black bristles.

*Thorax* rather broader than head, grey with three longitudinal black stripes, the outer pair rather broader than usual. Sides dark grey; under side grey; spiracle black with dark chocolate hairs. Three humerals; three intra-alars; the anterior acrostichals are absent; of the posterior acrostichals only the prescutellar are developed, and these only very weakly. Apical scutellars present.

*Legs* black. First femur clad with long hairs on proximal ventral half; tibia shorter than femur; hairless. Second femur hairy on proximal ventral two-thirds, distal third develops a "comb"; tibia hairless. Third femur and tibia hairy.

*Abdomen* covered dorsally with short reclinate bristles; below hairy. Hypopygium reddish brown, covered with rather short black hairs. Forceps dark brown, only slightly bristly; distal half developed into a hook, sharply pointed. Accessory plate small, brown, and provided with a few bristles. Two pairs of very dark brown claspers present; the posterior pair the smaller. Penis dark brown and black. From its anterior portion two powerful hooks are given off, below which the penis is developed into a rather thick complex prominence.

The description is from a male donated by Mr. Henry Tryon;—captured in Oahu, Hawaii.

24. *Sarcophaga milleri* n. sp.

(Fig. 1.)

*S. impatiens* Hudson (nec. Walker), Trans. N.Z. Inst., xxxiii., 1901, p. 62.

*S. impatiens* Miller (nec. Walker), Jour. Agric. New Zealand, xxii., 1921, p. 7.

In general appearance a pale golden and black fly, 9-10 mm. in length.

MALE.

*Head*.—Frons not very prominent, measuring about three-fifths the width of the eyes. Eyes red-brown, three-quarters the height of the head. Parafrontals and genæ pale golden, occiput silvery, a silvery streak being continued right round the eyes. Frontal stripe black, a quarter as wide again as parafrontals. Mesofacial plate very dark silvery, with black reflection, its borders black. A row of ten frontals beside frontal stripe. Verticals prominent; lateral verticals absent. First antennal

joint not very conspicuous; second prominent, black; third two and a half times the length of second. Epistome brownish. Vibrissæ large; eight facials and eleven epistomials. Palps and proboscis black. One very distinct line of black bristles behind eyes; these followed by numerous irregular rows on occiput and extending on to anterior part of genæ.

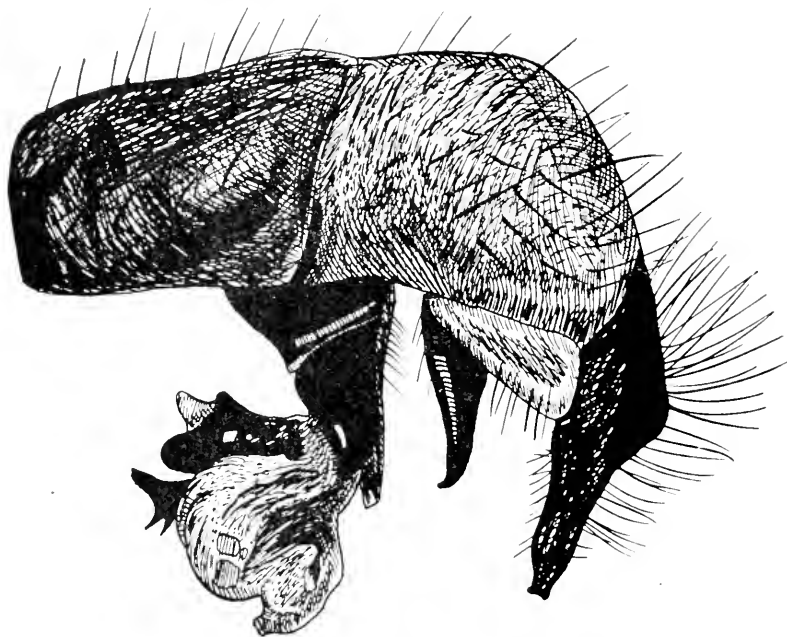


Fig. 1. *Sarcophaga mulleri* n. sp. Male genitalia.

*Thorax* slightly wider than eyes, with three longitudinal black lines, of which the middle one alone extends on to scutellum. Lateral and ventral walls grey and golden. All the acrostichals are absent. Dorso-central row complete; two intra-alars and three humerals. Anterior spiracle clothed with golden and chocolate hairs.

*Legs* black, femora tinged with grey on under side. First femur slightly hairy ventrally; tibia not hairy. Second femur hairy on proximal two-thirds; a very pronounced "comb" present. Third femur with a rather heavy growth of short hairs; tibia hairless.

*Abdomen* hairy below, clothed dorsally with very short black reclinate bristles. Abdomen black, the silvery fessellations practically absent. Both hypopygial segments black, covered with weak black bristles. Claspers shiny black; the penis is a fairly heavily chitinised structure, black and brown in colour. Forceps nearly black; their upper internal portions are brown, and the colour is continued upwards to form a large brown triangular patch at the back of the hypopygium. Forceps hairy almost to tips; the ends not pointed but terminating in a small triradiate knob.



## FEMALE.

This differs from the male in the following characters:—Frontal stripe as broad as parafrontals. Six frontal bristles beside frontal stripe, and three beside eyes; lateral verticals prominent. Eyes about three-fifths the height of head. Second femur not hairy, "comb" absent. Third femur and tibia hairless. Abdomen rounded, almost devoid of hairs ventrally.

Described from a male and a female from New Zealand sent to the authors by Mr. D. Miller, Government Entomologist, Wellington, New Zealand, and now deposited in the Australian Museum collection.

F. W. Hudson, in his synopsis of the Diptera Brachycera of New Zealand, recorded<sup>7</sup> only one local Sarcophagid, which he reported as very common, and regarded as being identical with *Sarcophaga impatiens* Walker. The above-mentioned insects were sent to us under this designation, but even a superficial examination shows them to be quite distinct from Walker's species.

25. *Sarcophaga multicolor* n. sp.

(Fig 2.)

In general appearance a large golden and black fly 12 mm. in length.

## MALE.

*Head*.—Frons half the width of eyes, which are reddish brown. Frontal stripe black, a little wider than parafrontals, which are dark gold in colour. Genæ and occiput bright gold. Mesofacial plates golden, borders tinged with black; ptilinal fissure not very distinct. First antennal joint scarcely visible; second large and black; third fawn colour, and nearly thrice the length of second. Height of eyes three-quarters that of head. A row of thirteen frontal bristles beside frontal stripe. A row of small black bristles immediately internal to the eye, the lowest two the largest. Verticals large; lateral verticals present but rather weak. Vibrissæ strong; about twenty facial bristles. A single row of black bristles behind eyes; an indistinct second row behind these towards the vertex of the head, but extending only a short way outwards. Hairs on occiput and genæ golden. Proboscis black with brownish tinge; palps black.

*Thorax* slightly wider than eyes; golden with the usual black stripes, of which the middle one alone extends on to the scutellum. The latter stripe much broader posteriorly than in front. Sides of thorax golden, tinged with black. Three humeral bristles present. Dorsocentral row as usual. Of the acrostichals only the prescutellar differentiated. Two intra-alars. Apical scutellars present.

*Legs* black. First femur tinged ventrally with gold; clothed with long thin bristles, beside the ordinary strong ones, but devoid of true hairs. Tibia slightly shorter than femur and not hairy. First tarsal joint less than one-third length of tibia. Whole tarsus about equal in length to tibia. The second and third femora are jet black and quite devoid of the usual golden or grey tinge. On the second femur the

<sup>7</sup> Hudson—Trans. N.Z. Inst., xxxiii., 1901, p. 62.

longitudinal row of bristles, which so often is differentiated into a "comb," is confined to the distal half, but the shortened condition of the bristles characteristic of that structure does not occur here. Second tibia slightly shorter than femur, hairless. Third femur distinctly hairy.

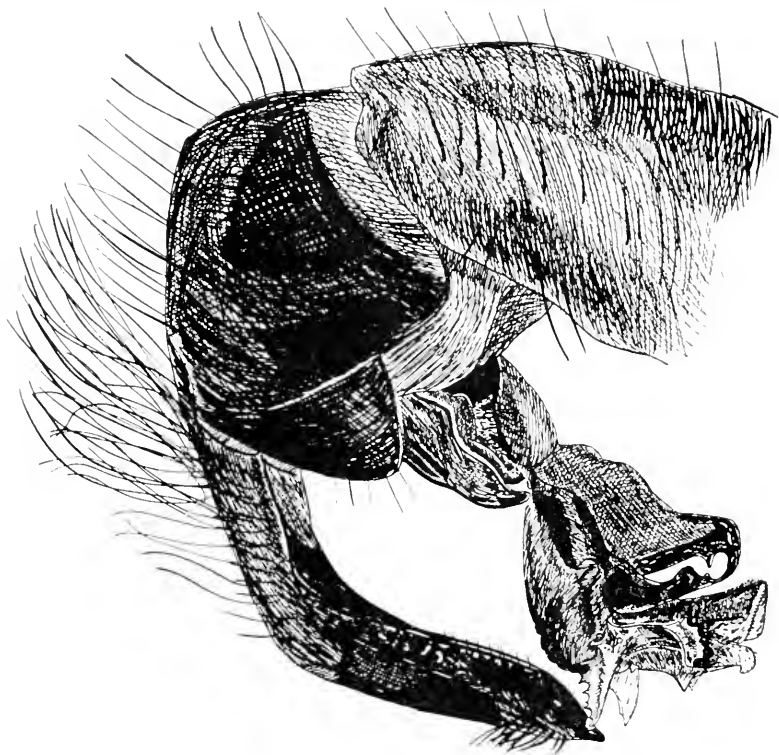


Fig. 2. *Sarcophaga multicolor* n. sp. Male genitalia.

Abdomen black and white as usual; the dark markings on the two segments immediately preceding the hypopygium, with a faint purplish tinge. Abdomen clothed with the usual reclinate bristles above, and with short hairs below, weakly in front, strongly behind. Hypopygial segments very dark brown, nearly black, clothed strongly with hairs, rather shorter than usual. Forceps shiny black, very faintly sculptured, sharply pointed, and distinctly curved. Termination armed with numerous short stout bristles; proximal half clothed with a scanty growth of rather long hairs. Accessory plate brown, not very prominent. Claspers brown. Proximal segment of penis brown, black posteriorly. The distal segment very large and exceedingly complex, possessing several distinct and in places strongly serrated processes. The form and arrangement of these structures is shown in Figure 2.

Described from a single male in the Australian Museum collection from Rabaul, New Britain.

# STUDIES ON BRYOZOA.

## PART 2.<sup>1</sup>

BY

REX W. BRETHERILL, late Invertebrate Zoologist, The Australian Museum.

(Figures 1-2.)

### I. ON A COLLECTION OF BRYOZOA FROM 26-38 FATHOMS OFF NORAH HEAD, NEW SOUTH WALES.

By the courtesy of Mr. A. P. Summergreene, General Manager of the State Trawling Industry, Messrs. F. A. McNeill and A. A. Livingstone, of the Australian Museum, were afforded the opportunity of accompanying the State trawler "Goonambree" on her cruise of June 15-19, 1921. Among the material obtained from the trawl was a small collection of Bryozoa, which is interesting since it includes two new species, and also forms that have not hitherto been recorded from the coast of New South Wales. The collection contains:—

*Catenaria cornuta* Busk.

*Caberea grandis* Hincks.

*Bugularia dissimilis* MacGillivray.

*Porina larealis* MacGillivray.

*Craspedozoum roboratum* Hincks.

*Launularia rubra* sp. nov.

*Conescharellina magniarmata* Maplestone.

„ *philippinensis* Busk.

„ *conica* Haswell.

*Selenaria livingstonei* sp. nov.

*Retepora monilifera* MacGillivray, form *munita* Hincks.

*Adeonellopsis foliacea* MacGillivray.

Some interesting forms of a new species of *Bipora* are also in the collection, but the description of this species which is being dealt with elsewhere, is not included here.

*Launularia rubra* sp. nov.

(Fig. 1.)

*Polyzoum*.—A top-shaped structure with a flat base, 3.5 mm. in height and 4 mm. at the diameter of the base.

*Diagnosis*.—The zoecia are roundly quadrangular and are arranged in radiating rows. The orifice, enclosed in a sloping peristome, is orbicular in shape and is protected by a yellowish operculum. The areas between

<sup>1</sup> For Part 1 see Records of the Australian Museum, Vol. xiii., No. 4, 1921, p. 157.

the orifices are granulated. Oœcia are absent. The vibraculæ are very plentiful and issue from small vibracular chambers situated between neighbouring zoœcia. The flagellæ are very long and golden, and are directed upwards and sideways, lying against the surface of the polyzoary.

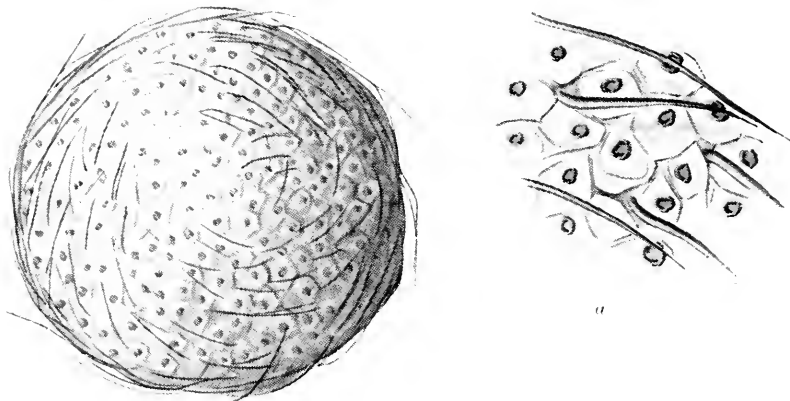


Fig. 1.—*Liomulania rubra* sp. nov. a Zoœcial detail.

The basal surface is polished and is decorated with furrows, which radiate from the centre, and a number of which again divide into two about half way between the centre and the edge.

*Colour* (dry and in alcohol) red.

*Locality*.—Off Norah Head, New South Wales, 26-38 fathoms.

*Holotype* in the Australian Museum. (U. 951.)

*Selenaria livingstonei* sp. nov.

(Fig. 2.)

*Polyzoary*.—A strong discoid growth 11 mm. in diameter and from 4 to 5 mm. in height. The zoœcia, arranged in radiating rows, are superficial and occupy the outer surface. The basal or inner surface is smooth, though decorated with occasional radiating lines of minute punctations, which can be seen under a microscope. A cross section of the polyzoary shows the zoœcia to be remarkably shallow and superficial; the structure other than these is entirely made up of fibrous calcite. The greatest thickness, that is at the apex, is 2.5 mm., and this slopes evenly to a thickness of 1 mm. at the edges.

*Diagnosis*.—The zoœcia are roundly quadrangular and are covered with a yellowish depressed cryptocyst, the distal borders of which are overlapping. They are arranged in a radiating series of thirteen from the apex to the edge. The orifice is minute and is orbicular in shape. Oœcia are absent. Vibraculæ are very plentiful, and small circular vibracular cells are situated between the zoœcial rows over the entire

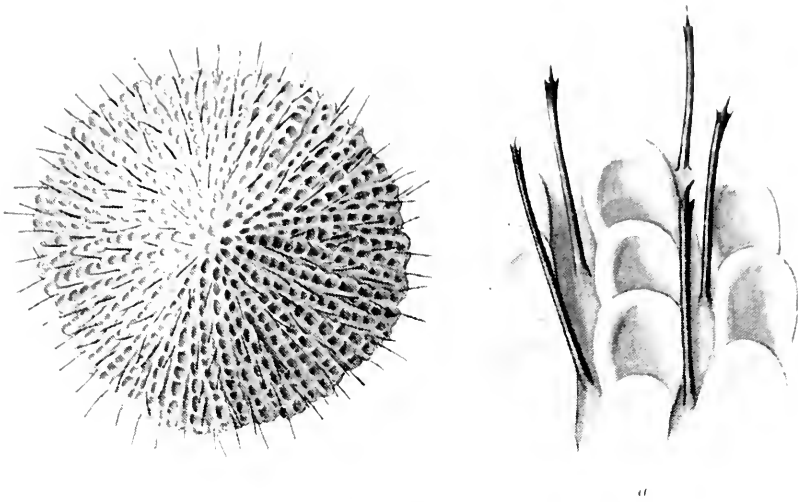


Fig. 2. *Selenaria livingstoni* sp. nov. a Zoecial detail.

surface. The flagellæ are almost rigid, deep brown in colour, with yellowish tips. Avicularia are absent.

*Colour and general appearance.*—Light brown and prickly.

*Locality.*—Off Norah Head, New South Wales, 26-38 fathoms.

*Holotype* in the Australian Museum. (U. 952.)

## 2. ON SOME SPECIES ALLOTTED TO THE GENUS *Bipora*.

An examination of the material detailed above has caused me to re-examine the specimens collected by H.M.C.S. "Miner" and described by Maplestone.<sup>2</sup> This author has followed Whitelegge's diagnosis<sup>3</sup> of his genus *Bipora*, which reads in part "Zoarium uni- or bilaminar, conical, or forming lobate or flabellate expansions." But the differences between the conical or top-shaped forms and those that are plate-like or fan-shaped are so marked, that one must give preference to the generic restrictions and emendations as proposed by Levinsen.<sup>4</sup> From my examination of the types then, the following species are removed from *Bipora* to the genus *Conescharcellina*.

*Bipora biarmata* Maplestone.

.. *multiarmata* Maplestone.

.. *maguariarmata* Maplestone.

.. *ampulla* Maplestone.

.. *mamillata* Maplestone.

.. (*Conescharcellina*?) *eburnea* Maplestone.

<sup>2</sup> Maplestone—Rec. Aust. Mus., vii., 4, 1909, pp. 267-273.

<sup>3</sup> Whitelegge—Proc. Linn. Soc., N. S. Wales (2), ii., 1888, p. 340.

<sup>4</sup> Levinsen—Morph. and Syst. Stud. Cheilostomatous Bryozoa, 1909, p. 311.

3. ON SOME *Nomina nuda* IN JELLY'S CATALOGUE.

Mr. W. M. Bale, of Kew, Victoria, has drawn my attention to some names of *Catenicella* and *Claciporella* in Jelly's "Synonymic Catalogue of the Recent Marine Bryozoa" that are credited to Goldstein. No literature reference is attached to these species, and I am at a loss to know how they could have been included. Prior to his decease Goldstein disposed of his collection of Bryozoa and I am at present unable to trace it, though I believe it to have been sent to England. Those who were closely associated with Goldstein in his work were unaware that he had these new species under consideration, though, referring to his observations on living Bryozoa in conjunction with Maplestone, he states<sup>5</sup> "We have a goodly number of new species to describe." Be that as it may, the names or descriptions of these species do not appear in any paper published by this author, and they should therefore be deleted from the catalogue.

The species referred to are:—

- Catenicella constricta* Goldstein, p. 35.
- „ *inflata* Goldstein, p. 37.
- „ *maccoyi* Goldstein, p. 37.
- „ *monstrosa* Goldstein, p. 38.
- „ *perplexa* Goldstein, p. 38.
- Claciporella bicornis* Goldstein, p. 63.
- „ *vacatua* Goldstein, p. 63.

Perhaps the most remarkable feature of these *nomina nuda* is that the two last mentioned have MacGillivray's names attached to them as probable synonyms.

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<sup>5</sup> Goldstein—Quart. Journ. Mic. Soc. Vict., i., 2, 1880, p. 49.

# DESCRIPTIONS OF SOME AUSTRALIAN FLIES BELONGING TO THE *DIPTERA BRACHYCERA*.

BY

G. H. HARDY.

(Plate xxxvi. and Figure 1.)

This paper contains the descriptions of a new genus and some new species of flies from Queensland, the material representing a portion of various recent collections from that State which I have been able to examine. I have also figured the allotype specimen of *Pelecorrhynchus fulvus* Ricardo, and added a reference under the same genus which was omitted in a previous paper. To Mr. D. J. Farrell I am indebted for assistance in the preparation of Plate xxxvi., figures 1, 2.

## STRATIOMYIIDÆ.

Genus *PACHYGASTER* Meigen.

*Status*.—The two species placed here probably belong to the genus *Eupachygaster*, which was proposed by Kertész,<sup>1</sup> as they are to be distinguished by the following characters:—

The scutellum is about half as long as broad, and has a semicircular outer margin on which are situated many minute spines; in the male, however, the scutellum is triangular in shape, rounded at the apex, and slightly inclined. In the female the facets of the eyes are of uniform size, and in the male they are much smaller below than above, but there is no sharp contrast between the two sizes.

I am unable to satisfy myself that *Eupachygaster* Kertész and *Neopachygaster* Austen are generically distinct from *Pachygaster* Meigen, and without seeing both sexes one cannot place a new species very satisfactorily. In the present case the characters certainly come nearest to those given by Kertész for the genus *Eupachygaster*.

Dr. E. W. Ferguson has a female which he captured on a window of his residence at Roseville, near Sydney, and it is identical with *P. whitei* Hardy. A male and a female of a second species were taken by him in the same place, but the male has the scutellum inclined to a considerable extent, and both sexes differ from *P. whitei* in various other respects.

In the meanwhile, until more material is available, it seems advisable to retain the genus *Pachygaster* in the wide sense adopted by most authors.

### Key to the Australian species of the genus *Pachygaster*.

1. Female with the thorax and abdomen evenly and densely punctate; scutellum with forty or more minute spines ..... *whitei* Hardy.  
Thorax of the female with considerably less and smaller punctures than those on the abdomen, which is densely punctate; scutellum with about thirty minute spines..... *utens* sp. nov.

<sup>1</sup> Kertész—Congr. Int. Ent., ii., 1911, p. 31.

## PACHYGASTER WHITEI Hardy.

*Pachygaster whitei* Hardy, Proc. Roy. Soc. Tasm., 1920, p. 44.

*Description*.—♀. Black. Head shining; eyes widely separated, facets of uniform size; antennæ yellowish red. There is some silvery pubescence around the base of the antennæ, on the face, also traces behind the eyes.

Thorax, scutellum, and abdomen uniformly and densely punctate over the whole upper surface. The scutellum lies horizontally and is semicircular in shape; on its outer border are forty or more minute (microscopic) spines. Legs yellow or yellowish red, but stained darker in parts. Wings hyaline and veins more or less stained black from the base to less than half the length of the wing; the remaining portions of the venation are yellowish. Cubital vein forked.

♂. The male is rather like the female but more slender in shape. It differs chiefly by the contiguous eyes, the facets of which are variable in size, the larger being on the upper side. Also the scutellum is triangular in shape with a rounded apex, and it is slightly inclined; the minute spines are less discernible than those on the female.

*Length*.— $3\frac{1}{2}$ – $4\frac{1}{2}$  mm.

*Hab*.—Tasmania, ? Victoria, and New South Wales.

*Types*.—The holotype female and the allotype male are in the Australian Museum.

PACHYGASTER NITENS *sp. nov.*

*Description*.—♀. Black. Head shining, eyes widely separated, facets of uniform size; antennæ yellowish. There is some silver pubescence around the base of the antennæ, on the face, and behind the eyes.

Thorax shining; it contains widely separated and small punctures over the whole upper surface. The scutellum lies horizontally and has punctures similar to those on the thorax; it is semicircular in shape, and on its rounded outer border there are about thirty minute (microscopic) spines. Abdomen densely punctate. Legs black, tarsi yellow. Wings hyaline; the veins black from the base to less than half the length of the wing; the remaining portions of the venation are yellow. Cubital vein forked.

♂. Male unknown.

*Length*.—Female, 4 mm.

*Hab*.—Queensland. The National Park, March 1921. Four females were captured in a tent during the hottest part of the day.

*Type*.—The holotype is in the Australian Museum.

Genus DOCHMIOCERA *gen. nov.*

This genus is proposed for a species of Stratiomyiid belonging to the sub-family *Pachygasterinae*. The oblique segments of the antennæ, from which the generic name is derived (oblique-horn) and the longer thorax will at once distinguish it from the genus *Pachygaster*, which it resembles in other respects.



*Characters*.—The antennæ contain ten segments, of which the first is clearly distinct; the second joint is askew and somewhat amalgamated with the third; the third to sixth segments form a third and complex joint, all the segments of which are askew, so that the apex (the base of the arista) is situated on what is apparently the side. The arista is composed of the seventh to tenth segments, the two basal ones very short, the next much longer, and the apical one very long. The scutellum is without spines. The wings have the cubital vein forked and contain four postical veins.

*Type* of the genus.—*D. aurilineata* sp. nov., Queensland.

DOCHMIOCERA AURILINEATA, *sp. nov.*

Plate xxxvi., figs. 1 and 2.)

*Description*.—♀. Black, with antennæ, venation, halteres, most of the legs and some tomentum, yellow.

Head broader than the thorax and black; behind the head a slightly elevated flange borders the upper margin of the eyes. Ocellar tubercle brown or black, and on each side is a shining black callus. These calli, bordering the inner margin of the eyes, extend nearly the full length of the front, and approach each other towards the antennal tubercle. The area enclosed by the calli is covered with a golden yellow tomentum. Antennal tubercle slightly prominent. Antennæ composed of ten segments and of the form described under the generic characters. Face brown, or brown and black, very short, and contains a little golden tomentum. The cheeks consist of very small strips behind the eyes and are either entirely covered with a silvery tomentum or are brown.

The thorax is rather long and black, and contains five stripes of golden yellow tomentum which alternate with four stripes of reddish tomentum; there are some slight traces of golden yellow tomentum ventrally. The scutellum is also rather long, and contains golden yellow tomentum on the sides.

The abdomen is considerably broader than the thorax, short, and black in colour; it contains conspicuous traces of golden yellow tomentum.

The legs have black or yellow coxæ; trochanters, two-thirds of femora, and base of tibiæ, are bright brownish yellow; on the posterior femora, in the holotype, there is a little black between these colours. The tibiæ are mostly black or black and brown, with a yellow central area which, however, is almost obsolete on the anterior legs. The anterior tarsi black; the intermediate or posterior tarsi yellow or white.

Wings hyaline with yellow veins. Mediastinal vein very faint and inconspicuous. Radial vein branches considerably before the intermediate cross vein. Cubital vein forked. The first and second postical veins are complete and rise independently from the distal cell; the third is absent; the fourth branches from the distal cell and is complete. The fifth meets the anal considerably before the wing margin. Anal vein sinuous.

♂. The male is not known.

*Length*.—5 mm.

*Hab.*—Queensland: the holotype from the National Park was taken at the end of February, 1921. The paratype is from Kuranda, and was taken by Mr. F. P. Dodd.

*Types.*—The holotype is in the Australian Museum and the paratype in Dr. E. W. Ferguson's collection.

*Note.*—Where alternative colour characters are given in the above description the first denotes that of the holotype and the second that of the paratype.

## TABANIDÆ.

### PELECORHYNCHUS FULVUS *Ricardo*.

(Plate xxxvi., fig. 3.)

*P. fulvus* Ricardo, Ann. Mag. Nat. Hist. (8), v., 1910, p. 406. *Id.* Taylor, Proc. Lin. Soc. N. S. Wales, xlv., 1919, p. 41. *Id.* Hardy, Rec. Austr. Mus., xiii., 1920, p. 38. *Id.* Ferguson, Proc. Roy. Soc. Vict., xxxiii., 1921, p. 2.

*Type.*—The allotype male, described by Dr. E. W. Ferguson, was presented to the Australian Museum. This opportunity is taken to publish a figure of the specimen; the head is drawn in the position corresponding to that of the specimen, and the shape of the proboscis is shown.

### PELECORHYNCHUS PERSONATUS *Walker*.

*Pelecorhynchus personatus* Ricardo, Ann. Mag. Nat. Hist. (7), v., 1900, p. 102.

*Amendment.*—The above reference was omitted from my paper "Notes on the genus *Pelecorhynchus*,"<sup>2</sup> where it should have been inserted after the reference to *Dasybasis personatus* Walker.

## ASILIDÆ.

### ASILUS ILLINGWORTHII *sp. nov.*

(Fig. 1.)

*Description.*—This species has the general appearance of *A. ferrugineiventris* Macquart, but in colour it has a slightly more reddish tinge.

♂. Head black, with traces of yellowish tomentum on the front and near the base of the antennæ; the tomentum occurs on the tubercle and covers the under side and rear of the head. Palpi black with black hairs. Monstache pale yellow, with one or two black hairs above. A few pale yellow hairs on the sides of the front and behind the head. Post-ocular bristles yellow. Antennæ reddish yellow, the third joint stained black on the paratype male; first joint longer than the second; the third scarcely as long as the two basal joints together; apical arista about as long as the third joint. Proboscis black with a few black hairs. Thorax black,

<sup>2</sup> See Records of the Australian Museum, vol. xiii., No. 1, 1920, p. 33.

but with a reddish tinge in places; it contains black bristles, a few yellow hairs, and a little yellow tomentum. On each side of the median line there are three presutural bristles, three superalar, two postalar and four intermediate. There are two bristles on the scutellum.

Abdomen black, with the apical margins of the segments, the sides, and the whole of the venter, reddish yellow. On the dorsal surface some of the hairs are black, but the majority appear to be yellowish, and there are two or three long lateral hairs on some of the basal segments.

Male genitalia are black, with a pair of very simple upper forceps, which are a little separated, and which bend downwards at the apex. The lamella does not project dorsally, but can be seen from the dorsal side and from the rear; it is situated in the usual place, and lies horizontally. The lower forceps contain a small apical projection at the lower border.

Legs yellow, but the intermediate coxæ and all the tarsi are stained with black. The anterior femora are without bristles. The intermediate femora have on the anterior side two widely separated bristles representing the upper row and three representing the lower; on the posterior side there is a bristle placed about three-quarters of its length, and also one subapical. The posterior femora have on the anterior side an upper row of three widely separated bristles and a lower row of four; an extra subapical bristle may also be present. The ventral row is represented by a few bristles, which vary in position on the different specimens. The posterior side of the femora contains a pair of subapical bristles, and another bristle is placed almost dorsally at about seven-eighths its length. The tibiae and tarsi also contain bristles. Most of the bristles are black.

♀. The female is similar to the male; the ovipositor is normal.

*Length.*—Male 19 mm., female 18 mm.

*Hab.*—Queensland: Cairns, January 1921, 2 males and 3 females collected by Dr. J. F. Illingworth in the sugar-cane fields; Claudie River.

*Types.*—By the courtesy of Dr. Illingworth the holotype and allotype have been presented to the Australian Museum. Three paratypes are in Dr. Illingworth's collection and two in the National Museum, Melbourne.

*Note.*—It is reported that this species in the larval stage is predaceous upon sugar-cane grubs.

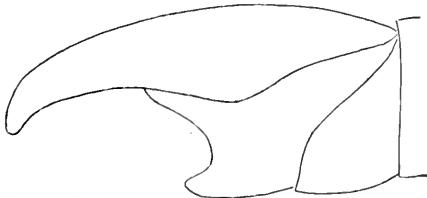


Fig. 1. *Asilus illingworthi*, sp. nov. The male genitalia seen laterally

A DESCRIPTION OF *HETEROMETOPIA ARGENTEA*  
MACQUART (*DIPTERA DEXIIDÆ*).

BY

G. H. HARDY.

(Plate xxxvii.)

This paper is the first of a series in which it is proposed to describe, more thoroughly than has hitherto been done, those Australian species of the Calyptrata which are the typical forms of various genera proposed by the earlier authors such as Macquart and Walker.

Considerable difficulty has been experienced in determining the genera and species that were described by most of these earlier authors, partly owing to the inadequate descriptions, and partly to the lack of the complete literature dealing with the subject; nevertheless a certain amount of recent and useful information has been and is still being published upon this group of Diptera, and this, together with the literature available at the present time, has made it possible for me to ascertain the identity of various species.

The Dexid described here was originally placed under the Tachinidæ, and besides being typical of its genus it is the origin of a curious phenomenon which forms a subject matter under the notes. Moreover the sexes are determined, and the female is now described for the first time, unless perchance it has been described previously under another name.

*HETEROMETOPIA ARGENTEA* Macquart.

(Plate xxxvii.)

*Heterometopia argentea* Macquart, Dipt. Exot. suppl. 1, 1846, p. 170; Pl. xvi., fig. 1.

*Colours*.—Seen from the front the whole dorsal surface of the male appears to be silvery; this is due to a tomentum which is seen at its best in this position. As the insect is turned to some other position the ground colours become apparent, and are seen at their best when viewed from the rear. There is less silvery tomentum in the female, and the ground colours can be seen at any angle.

In the male the head appears to contain brownish, yellowish, and black colours; the frontal suture is closed. In the female the head is mostly brownish, and the frontal suture is open and black. The eyes are black. The antennæ are black, with the basal joints and the first segment of the arista brown. In the male the thorax and scutellum are black; in the female these areas are mostly black, but more or less covered with a white tomentum. Anteriorly to the transverse suture the female has the anterior border and sides, and also two median stripes, covered with a white tomentum, which further covers the apical quarter of the thorax and the whole of the scutellum.

In the male the abdomen is brown, with a central dorsal black stripe which expands on and covers the apical half of the third segment; the fourth segment is black and nearly completely covered dorsally with a yellow tomentum. In the female the abdomen dorsally is black with white tomentum on the incisions of the segments; nearly the whole of the fourth segment is covered with a yellow tomentum; this tomentum extends to the fourth segment of the otherwise black venter.

All hairs, bristles, and legs are black.

*Bristles.*—The head contains two pairs of vertical bristles; the outer divergent pair are smaller than the inner convergent pair. One very slender pair of postvertical convergent bristles; two pairs of ocellar, the posterior erect and small, the anterior strong and proclinate. In the male there is only one pair of reclinate-divergent frontal bristles; the female has three additional pairs, of which the middle are proclinate and the others proclinate-divergent. About four pairs of cruciate bristles. Below each vibrissa there is a row of about ten convergent-proclinate bristles near the oral margin. Postorbital bristles very small.

The dorsal bristles of the thorax are disposed on each side of the median line as follows:—Three humeral; one strong (central) and two weak posthumeral; two notopleural; one presutural; two supra-alar; two intra-alar; two post-alar; six dorso-central; one apical acrostichal. The other acrostichal bristles are mostly obsolete, but if present are very small.

The ventral bristles of the thorax are disposed on each side as follows:—Three or four pro-pleural; a row of seven meso-pleural situated on the border nearest the insertion of the wings; three sterno-pleural; three ptero-pleural, small, situated immediately above and forming part of the tuft of hairs below the insertion of the wings; about six hypo-pleural.

The scutellum contains three pairs of long bristles—one lateral near the base, reclinate; one lateral in the centre, divergent; and one apical, cruciate. Sometimes there is also a small pair placed widely apart on the dorsum.

The abdomen contains a pair of lateral bristles on the apical margin of the first segment, one lateral and one median pair on the apical margin of the second segment, about six dorsal pairs of marginal bristles on the third and fourth segments, and about as many ventral.

*Length.*—9 mm.

*Hab.*—Tasmania: Dunalley, seven males and six females; Hobart, one male; Geeveston, one male; Launceston, one male; October to December. New South Wales: Mount Kosciuszko, one male, taken by Dr. E. W. Ferguson.

*Types.*—The specimen from which the male description is taken and the allotype female are in the Australian Museum.

*Notes.*—About the middle of November, 1917, in a valley at Dunalley, Tasmania, I noticed the glimmer of a male specimen in a crack of a very much charred dead tree, from which after diligent search another specimen was taken. In the same locality a day later my wife took a series containing both sexes from the under side of a fallen tree lying well above the ground. Other specimens have been taken in widely separated places prior to this, but invariably there were males only.

A curious phenomenon that has excited the interest of most collectors in Tasmania is to be found in the sudden disappearance of the male of this fly when in flight. A specimen may be seen approaching as a silvery white spot, which suddenly disappears. This apparition may be observed several times a day, and only with difficulty can it be netted. Now if the insect be slowly turned round it will be noticed that when seen from the front the other colours are completely obliterated by a silvery sheen, but viewed from the sides or rear the thorax is black and the abdomen is brown with a dark central stripe. It is evident, therefore, that the silvery spot approaching is the insect advancing with the head towards the observer, and a more conspicuous insect is not to be seen in the bush, but immediately the insect turns the silver colour is lost, and the fly becomes invisible to the eye, which cannot follow the rapid change in colour.

## MINERALOGICAL NOTES: No. XI.

BY

C. ANDERSON, M.A., D.Sc., Director.

(Plates xxxviii.-xli.)

### DIAMOND.

Near Boggy Camp, Inverell, N.S.Wales.

(Pl. xxxviii., fig. 1, Pl. xxxix., fig. 1.)

An interesting diamond crystal from this field was lent by Mr. D. A. Porter for measurement and description. The diamonds at this locality are found in deposits of sand and gravel, probably of Pliocene age, underlying the basalt capping of a number of isolated hills; they are accompanied by stream tin and a little gold.

The crystal weighs .0443 grams. It is colourless, and consists of a hexakis-octahedron with indices near (111), twinned on an octahedral face (spinel law), and flattened parallel to the twin plane to form a triangular plate; diamonds of this shape are known at Amsterdam as *naadsteen* (suture stones). Only six faces of each half of the twin are developed, forming a very low pyramid with curved edges and planes, each face striated in lines running roughly parallel to its intersections with an octahedral face, but towards the periphery the striations curve in conformity with the crystal edges and gradually disappear. A few small triangular depressions appear near the apex, the corners of the pits, as is usual in natural etch pits of the diamond, being directed towards an adjacent octahedral edge.

In order to investigate the "light paths," the crystal was mounted on a two-circle goniometer so that the plane of the triangular plate was approximately parallel to the plane of the vertical circle. Six trails of reflection were found, radiating in pairs from the apex (the centre of Pl. xxxviii., fig. 1), but not reaching quite to the centre. The crystal was adjusted so that the point of intersection of these six paths was approximately polar, and then a large number of readings was taken along each path. The results are plotted in stereographic projection in Pl. xxxix., fig. 1.

Two other diamonds from the same locality in Mr. Porter's collection merit a short description. Both are slightly yellowish; one is a distorted octahedron weighing .1 gram and built up by a number of parallel and sub-parallel plates; the other, which weighs .13 grams, is a symmetrical triakis-octahedron with rounded edges.

## ANGLESITE.

Dundas, Tasmania.

(Pl. xxxviii., figs. 2, 3, Pl. xxxix., figs. 2-6.)

At the Dundas mines anglesite is a characteristic mineral occurring in well developed crystals, which are sometimes of large size. In a previous paper<sup>1</sup> a crystal from the old Maestries Mine was described and figured, and the occurrence of the mineral has been referred to by the late W. F. Petterd.<sup>2</sup>

A hand specimen was recently presented by Mr. E. Hull. It is not known from what mine the specimen came, but, as it carries crystals of a habit unusual for the Dundas anglesite, some of them were measured and one is figured (Pl. xxxix., figs. 2, 3). The crystals are transparent and glassy, and occur in vughs in a matrix of galena; a few crystals of cerussite are also present. The anglesite is tabular in habit and elongated parallel to the *b* axis, the largest crystals being about ten mm. long; only *m* (110) is present in the prism zone, and no brachy-domes are developed, the largest faces being *c* (001) and *l* (104).

Four exceptionally fine specimens of anglesite from the Comet Mine, Dundas, were recently added to the collection. One of these consists of a mass of beautifully developed, clear, colourless crystals of moderate size, accompanied by limonite. The limonite was formed prior to the anglesite, and is stalactitic, the anglesite being deposited round the stalactites; the limonite when fresh is seen to have a radiated structure, but as a result of decomposition it has been largely converted into a yellow powder or completely removed, leaving a series of parallel tubes penetrating the anglesite.

The crystals were found to be exceptionally rich in faces, a total of fifteen forms, one of which is new, being established. The combinations observed on six crystals are tabulated below.

Cryst.	<i>c</i> 001	<i>a</i> 100	<i>b</i> 010	<i>m</i> 110	<i>u</i> 120	<i>k</i> 130	<i>o</i> 011	<i>d</i> 102	<i>l</i> 104	<i>z</i> 111	$\tau$ 221	<i>r</i> 112	<i>y</i> 122	*	<i>p</i> 324
I.	x	-	-	-	-	-	-	-	-	-	-	-	-	x	x
II.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
III.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IV.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VI.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<sup>1</sup> Anderson—Rec. Austr. Mus., vi., 1905, pp. 90-91, pl. xix., fig. 3.

<sup>2</sup> Petterd—Papers and Procs. Roy. Soc. Tas., 1900-1 (1902), p. 83; Cat. Mins. Tas., pp. 8-9 (Hobart, Govt. Printer, 1901).



The habit of the crystals on this hand specimen are shown in the drawing of Crystal No. IV. (Pl. xxxix., figs. 5, 6), but the individual faces vary considerably in size and shape; the largest crystals approximate to eight mm. in length along the  $b$  axis.

Forms and angles:—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$c$ 001	—	—	—	—
$a$ 100	90 00	90 00	90 00	90 00
$b$ 010	00 02	90 00	00 00	90 00
$m$ 110	51 51	90 00	51 51	90 00
$n$ 120	32 30	90 00	32 29	90 00
$k$ 130	22 51	89 59	23 00	90 00
$o$ 011	00 01	52 12	00 00	52 12
$d$ 102	90 00	39 22	90 00	39 23
$l$ 104	89 57	22 19	90 00	22 19
$r$ 112	51 51	46 12	51 51	46 14
$z$ 111	51 51	64 24	51 51	64 24
$\tau$ 221	51 52	76 32	51 51	76 32
$y$ 122	32 29	56 48	32 29	56 48
$\bullet$ 368	32 33	48 43	32 29	48 54
$p$ 324	62 23	54 16	62 22	54 16

The new form (368) was observed eight times. It is a fairly large face, but is generally wavy, and the signals are only moderately good; the limits obtained for the co-ordinate angles were  $\phi$   $32^{\circ} 25'$  to  $32^{\circ} 46'$ ,  $\rho$   $48^{\circ} 38'$  to  $48^{\circ} 47'$ .

The other three specimens from the Comet Mine are remarkable for the size of the crystals. One consists of a single crystal measuring  $11.5 \times 4 \times 3.5$  cm. (Pl. xxxviii., fig. 2), the others are aggregates of crystals, the largest about  $3 \times 2.5 \times 1.75$  cm. (Pl. xxxviii., fig. 3).

These also are penetrated by limonite stalactites, mostly powdery, and are elongated parallel to the vertical axis. There are only a few forms present, namely *c* (001), *a* (100), *m* (100), *d* (102), of which the two last are the best developed (Pl. xxxix., fig. 4).

C.S.A. Mine, Cobar, N.S.Wales.

(Pl. xl., figs. 1, 2.)

A specimen lent by Mr. Arthur Combe consists of anglesite in small crystals, the largest about 5 mm. in diameter, accompanied by limonite and small spherules with a pearly lustre which dissolve in hot hydrochloric acid with effervescence, giving a yellow solution containing much iron; these spherules are apparently siderite or ferruginous calcite. Anglesite has not previously been recorded from this lode, the outcrops of which consist of ferruginous and siliceous gossan, with native silver, chloride of silver, azurite, malachite, cerussite, and other minerals, passing downwards into sulphides of iron, copper, lead, and zinc.<sup>3</sup>

The crystals of anglesite are fairly constant in habit, the largest faces belonging to *c* (001), *m* (110), *d* (102), *o* (011).

Forms and angles :—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
<i>c</i> 001	—	—	—	—
<i>a</i> 100	90 05	89 58	90 00	90 00
<i>m</i> 110	51 51	90 14	51 51	90 00
<i>d</i> 102	90 24	39 30	90 00	39 23
<i>l</i> 104	90 27	22 02	90 00	22 19
<i>o</i> 001	00 04	52 18	00 00	52 12
<i>z</i> 111	52 03	64 35	51 51	64 24
<i>y</i> 122	32 39	57 04	32 29	56 48
<i>p</i> 124	32 31	37 25	32 29	37 23

<sup>3</sup> Andrews—Dept. of Mines N.S.Wales, Min. Resources No. 17, 1911, Pt. I., pp. 163-169.

## Mt. Stewart, near Leadville, N.S.Wales.

(Pl. xl., figs. 3, 4.)

On two of the specimens of pyrite (see below) presented by Mr. Combe are some small, transparent, well-formed crystals of anglesite, which occur in nests in the sphalerite, mostly associated with, and in one case intergrown with, quartz. The faces of the measured crystal are smooth and give splendid reflections, with the exception of one, which occurs twice, and is vicinal to the base in the zone (100:001); the values obtained for  $\rho$  of this face were  $7^{\circ}21'$  and  $6^{\circ}41'$ , average  $7^{\circ}1'$ . The crystals are tabular on the base, which is the largest face.

Forms and angles:—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
c 001	—	—	—	—
a 100	89 59	90 00	90 00	90 00
m 110	51 52	90 00	51 51	90 00
o 011	00 01	52 14	00 00	52 12
d 102	90 00	39 23	90 00	39 23
z 111	51 51	64 24	51 51	64 24
y 122	32 28	56 48	32 29	56 48

## PYRITE.

## Mt. Stewart, near Leadville, N.S.Wales.

(Pl. xxxix., fig. 7.)

Finely crystallised pyrite occurs at this mine. A magnificent example, a block 18 x 14 inches and consisting principally of perfect cubes measuring up to  $1\frac{1}{4}$  inches along the edge, has been figured by Mr. G. W. Card.<sup>4</sup> The mineral is argentiferous, and contains about four pounds of bismuth to the ton; it is used in the manufacture of sulphuric acid.

A fine series of the characteristic minerals occurring at Mt. Stewart has been presented to the Museum collection by Mr. A. Combe. One large specimen consists entirely of pyrite, the crystals crowded together

<sup>4</sup> Card—Rec. Geol. Surv. N.S.Wales, III., 1893, p. 125 (figd.); Handbook Min. and Geol. Museum, Sydney, pl. iv. (Sydney, Dept. Mines, 1902).

and comparatively small, the largest measuring about five mm. along the cube edge. The crystals are chiefly cubes modified by narrow faces of the pyritohedron (210) and minute faces of the octahedron (111) and the diploid (213). A few of the crystals are pyritohedral in habit, but are poorly developed. This specimen, like the others mentioned below, was obtained at a depth of about 200 feet (the "intermediate stope"). The remainder of the collection consists of smaller hand specimens, in which the pyrite is accompanied by sphalerite, anglesite, and quartz. Mr. Combe also showed me a specimen of copper sulphate which he had found in a small vugh a little higher up. Pyromorphite in simple hexagonal crystals terminated by the basal plane is also found at this mine.

Forms and angles:—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	o    i	o    i	o    i	o    i
a 100	00 01	90 00	00 00	90 00
102	00 01	26 34	00 00	26 34
c { 021	00 00	63 35	00 00	63 26
210	26 36	89 58	26 34	90 00
o 111	45 01	54 54	45 00	54 44
213	26 58	36 28	26 34	36 42
s { 132	18 20	57 50	18 26	57 41
321	34 39	74 52	33 41	74 30

## GARNET.

Broken Hill, N.S.Wales.

(Pl. xl., fig. 5.)

At Broken Hill garnet occurs in the garnet-sillimanite-gneiss, in the garnet-sandstone, which is closely associated with the ore deposits, and in the ore itself, where it is accompanied by galena, sphalerite, and rhodonite. It appears that the garnet of the garnet-sandstone and the lode is the manganese variety spessartite, a fact which was, I believe, first pointed out by Mr. D. A. Porter.<sup>5</sup> Professor E. W. Skeats<sup>6</sup> has examined sections

<sup>5</sup> Porter—Journ. Roy. Soc. N. S. Wales, xxviii., 1894 (1895), p. 41; cp. Trans. Austr. Inst. Min. Engineers, xv., Pt. I., 1911, pp. 185-188.

<sup>6</sup> Skeats—Trans. Austr. Inst. Min. Engineers, *loc. cit.*, p. 186.

of the garnet-sandstone, and inclines to the view that the garnet is a secondary mineral formed at the same time as the lode minerals, but just prior to the formation of the metallic minerals.

A fine crystal of spessartite from the Junction North Mine presented to the Museum by Mr. Combe was measured on the goniometer. The crystal, which has a diameter of 13 mm., is of a deep red colour and highly lustrous. It is bounded by faces of the trapezohedron  $u$  (211), which are developed in almost ideal symmetry. The presence of the forms  $d$  (111) and  $s$  (123) is indicated by very narrow planes and striations in the faces of  $u$  as shown in the figure. A little galena is attached to the garnet.

Forms and angles :—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
$d$ 101	00 04	44 53	00 00	45 00
$u$ { 112	45 00	35 15	45 00	35 16
121	26 34	65 50	26 34	65 54
$s$ 123	26 43	36 39	26 34	36 42

A very complete analysis by Mr. H. P. White of spessartite from this mine will be found in the Annual Report, Department of Mines N.S.Wales, for 1912 (1913), p. 197.

### ANATASE.

Wild Kate Mine, near Deepwater, N.S.Wales.

(Pl. xl., fig. 6.)

This mineral, which is comparatively rare in Australia, has recently been found at the above locality, which is celebrated for its fine wolframite crystals.<sup>7</sup> The crystals, which measure up to 4 mm. along the vertical axis, were found embedded in a clay pocket, and I am indebted to Inspector G. Smith for bringing them under my notice. They are slaty-brown in colour, doubly terminated, and of pyramidal habit,  $c$  (001),  $m$  (110), and  $\rho$  (111) being the dominant forms. The faces are brilliant but interrupted, and the goniometer signals are frequently multiple. Three crystals were measured with the following results :—

<sup>7</sup> Anderson—Rec. Austr. Mus., v., 1904, p. 303, pl. xli.

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
<i>c</i> 001	—	—	—	—
<i>m</i> 110	44 59	89 57	45 00	90 00
<i>e</i> 011	00 01	60 38	00 00	60 38
<i>p</i> 111	44 55	68 13	45 00	68 18
<i>k</i> 112	45 07	51 33	45 00	51 29

Sir Douglas Mawson, in a paper<sup>8</sup> describing anatase from the Glen Osmond Quarry, Adelaide, makes the statement that anatase is there recorded for the first time from Australia. That is not quite correct, for it has previously been recorded, though with very meagre descriptions, from Burradong and the Cudgegong River, N.S.Wales,<sup>9</sup> from Pakenham<sup>10</sup> and the Woolshed Valley,<sup>11</sup> Victoria, and from Clayton Rivulet and other localities in Tasmania.<sup>12</sup>

### SULPHUR.

Hot Lakes District, New Zealand.

(Pl. xli., fig. 1.)

The Museum collection contains a number of specimens of native sulphur, coating siliceous sinter, from the above locality. The sulphur is in minute crystals, the largest not much bigger than a pin's head, but they are well formed, brilliant, and fairly rich in forms. Four crystals were measured and sixteen forms were identified; in addition  $\lambda$  (210) is doubtfully present. The combinations are shown below:—

Cryst.	<i>c</i>	<i>a</i>	<i>b</i>	<i>m</i>	$\lambda$	<i>e</i>	<i>u</i>	<i>u</i>	<i>v</i>	<i>t</i>	<i>s</i>	<i>y</i>	<i>q</i>	$\gamma$	<i>z</i>	<i>x</i>	<i>q</i>
	001	100	010	110	210	101	103	011	013	115	113	112	111	331	135	133	131
I.																	
II.																	
III.																	
IV.					?												

<sup>8</sup> Mawson—Trans. Roy. Soc. S. Austr., xl., 1916, p. 262.

<sup>9</sup> Livensidge—Minerals of N.S.Wales, 1888, p. 84.

<sup>10</sup> Newbery—Rept. Prog. Geol. Surv. Vict., 1876 (1877), No. 4, p. 168.

<sup>11</sup> Dunn—Bull. Geol. Surv. Vict., 25, 1913, p. 7.

<sup>12</sup> Gould—Proc. Roy. Soc. Tas., 1873 (1874), p. 57; Petterd—Cat. Mins. Tas., p. 7 (Hobart, Govt. Printer, 1910).

## Forms and angles :—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "
<i>c</i> 001	—	—	—	—
<i>a</i> 100	90 05	89 59	90 00	90 00
<i>b</i> 010	00 00	89 58	00 00	90 00
<i>m</i> 110	50 52	90 00	50 51	90 00
$\lambda$ 210	68 48	88 49	67 51	90 00
<i>e</i> 101	90 03	66 53	90 00	66 52
<i>u</i> 103	90 02	38 01	90 00	37 58
<i>n</i> 011	00 00	62 17	00 00	62 18
<i>v</i> 013	00 01	32 23	00 00	32 25
<i>t</i> 115	50 52	31 06	50 51	31 07
<i>s</i> 113	50 52	45 12	50 51	45 10
<i>y</i> 112	50 51	56 28	50 51	56 28
<i>p</i> 111	50 52	71 39	50 51	71 40
$\gamma$ 331	50 53	83 41	50 51	83 42
<i>z</i> 135	22 19	50 58	22 16	51 01
<i>x</i> 133	22 18	64 05	22 16	64 06
<i>q</i> 131	22 16	80 49	22 16	80 48

## New Hebrides.

(Pl. xli., fig. 2.)

Our collection contains a few specimens of native sulphur from the New Hebrides, where considerable deposits are found round the fumaroles, particularly in the neighbourhood of Yasowa on Tanna, and on Vanua Lava.<sup>13</sup> One specimen, found on Tanna in 1865, consists of crystals thickly deposited on a fine friable matrix resembling volcanic ash. The crystals, which range up to eight mm. in length, are very simple, some showing only the forms *c* (001) and *p* (111), others having faces of *s* (113) and *n* (011) as well. The faces, though interrupted, are smooth and give excellent signals, the measured agreeing well with the calculated angles.

<sup>13</sup> Pelatan—*Fide* Min. Industry, 1894, p. 517; Mawson—*Proc.* Linn. Soc. N.S. Wales, xxx., 1905, p. 434.

A curious form of sulphur from near Traitor's Head, Erromango, is in the Museum collection. It consists of hollow spherules, measuring up to three mm. in diameter, which have no doubt been formed by gas bubbles when the sulphur was in a molten state. Similar hollow spheres of sulphur have been described by Ōhashi, from the crater lake of the volcano Shirane, Province Kōzuke, Japan.<sup>14</sup> The Erromango spheres are usually perforated by a small circular puncture, with a slightly raised rim, through which the imprisoned gas doubtless escaped. Some have a stalk, or a globular wart, evidently formed by the gas pressure forcing out the wall of the spherical shell at a weak spot. The surface of the spherules has a glazed appearance.

### SPHALERITE.

Spring Creek, Bungonia, N.S.Wales.

(Pl. xli., figs. 3, 4.)

Sphalerite is of common occurrence in mineral veins at various Australian localities, but it is seldom found in good crystals. The specimen described here was brought under my notice and subsequently presented to the Museum by Mr. Combe. In our collection there was previously a large hand specimen from this locality, consisting of massive sphalerite, with a few indistinct crystals in association with crystallised quartz, galena, and chalcopyrite. The sphalerite is almost black externally, but on cleavage it shows an amber colour.

The figured crystal is a doublet on the tetrahedral face (spinel law); the two segments interpenetrate and are elongated parallel to the tetrahedral axis, so that the crystal is pseudo-hexagonal in section, the hexagon being formed by the faces of the dodecahedron. The only forms present are the tetrahedron and the dodecahedron, the former predominating. For measurement the crystal was mounted on the goniometer with a tetrahedral face polar. The faces of the tetrahedron are dull and give poor reflections, but the dodecahedron is brilliant.

<sup>14</sup> Ōhashi—Journ. Akita Mining College, No. 1, 1919.



Forms and angles:—

Form.	Measured.		Calculated.	
	$\phi$	$\rho$	$\phi$	$\rho$
$d\ 101$	29 59	89 59	30 00	90 00
$\sigma\ 111$	00 01	35 16	00 00	35 16
$\sigma\ 111$	00 08	70 59	00 00	70 32

### AZURITE.

Cobar, N.S.Wales.

(Pl. xli., fig. 5.)

In Inspector G. Smith's collection there are a number of specimens of azurite from the Cobar Gladstone Mine, which he kindly placed at my disposal for description. On some of the hand specimens the crystals are large, coarse, and quite unsuitable for measurement, but others carry small crystals, two of which were detached and measured. On account of their softness and crowded condition it was not easy to obtain crystals adapted for the goniometer. The matrix is a mixture of sulphides and oxides of copper and iron.

The crystals are elongated parallel to the  $b$  axis and tabular on the basal plane, the largest faces belonging to  $c$  (001),  $R$  (241),  $h$  (221), and  $\sigma$  (101); on one crystal narrow faces of the unit prism  $m$  (110) were found. The faces in the zone [100:001] are striated parallel to their intersections, and between  $c$  and  $\theta$  ( $\bar{1}01$ ) is a rounded area which gave an almost continuous series of signals which could not be assigned to definite forms. A similar area was found on the azurite of Mineral Hill, Condo-bolin, N. S. Wales.<sup>15</sup>

For measurement the crystals were mounted with the zone [100:001] equatorial, which would make the  $b$  pinacoid (not present) the polar plane, and in the table  $\phi'$ ,  $\rho'$ , are the co-ordinate angles for this position, the angles  $\phi$ ,  $\rho$ , for the normal position being placed alongside. The angles are calculated from the elements obtained for the Mineral Hill azurite.<sup>16</sup>

<sup>15</sup> Anderson—Jour. Roy. Soc. N.S.Wales, li., 1917, pp. 278-279.

<sup>16</sup> Anderson—*Loc. cit.*, pp. 281-284.

Forms and angles:—

Form.	Measured.		Calculated.		Normal.	
	$\phi'$	$\rho'$	$\phi'$	$\rho'$	$\phi$	$\rho$
	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "
<i>c</i> 001	87 35	89 59	87 35	90 00	90 00	02 25
<i>a</i> 100	00 02	90 00	00 00	90 00	90 00	90 00
<i>m</i> 110	00 17	49 24	00 00	49 25	49 25	90 00
<i>l</i> 023	87 35	59 24	87 35	59 27	04 06	30 38
<i>p</i> 021	87 40	29 34	87 35	29 28	01 22	60 34
$\sigma$ 101	43 02	90 00	42 53	90 00	90 00	47 07
$\theta$ 101	45 15	90 00	45 14	90 00	90 00	44 46
$\eta$ 302	33 31	90 00	33 32	90 00	90 00	56 28
<i>h</i> 221	25 41	52 57	25 21	52 50	50 00	70 03
<i>P</i> 223	53 44	64 38	53 48	64 31	51 06	43 14
<i>x</i> 111	45 02	57 48	45 12	57 49	48 14	53 05
<i>k</i> 221	26 35	52 00	26 16	51 54	48 50	69 37
<i>R</i> 241	26 27	32 34	26 16	32 32	29 46	76 14
<i>e</i> 245	69 46	56 25	69 38	56 25	27 39	38 39
$\rho$ 134	77 50	57 04	77 57	57 01	18 02	34 56

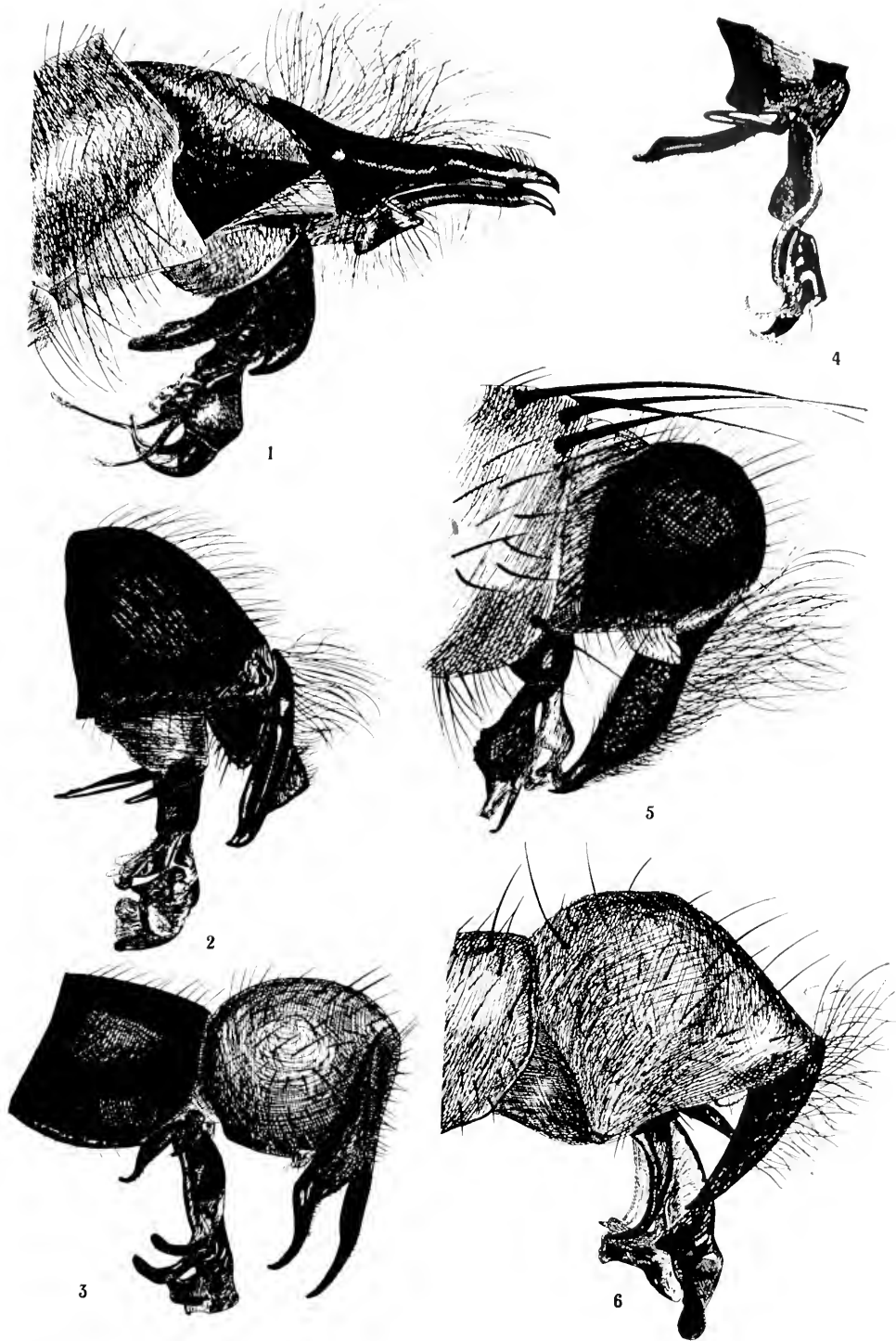
In conclusion I have to record my indebtedness to Messrs. G. Smith, D. A. Porter, and A. Combe (whose transference to the Geological Survey of Uganda is a signal loss to Australian mineralogy), for the loan of specimens, for donations, and much useful information, and to my colleague, Mr. T. H. Smith, for valuable assistance in measuring and drawing the crystals and checking the calculations.



EXPLANATION OF PLATE XXXV.

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- Fig. 1. *Sarcophaga epsilon* n. sp., male genitalia.  
„ 2. *S. littoralis* n. sp., male genitalia.  
„ 3. *S. hæmorrhoidalis* Fallen, male genitalia.  
„ 4. *S. depressa* R. D., male genitalia.  
„ 5. *S. hardyi* n. sp., male genitalia.  
„ 6. *S. pallinervis* Thomson, male genitalia.





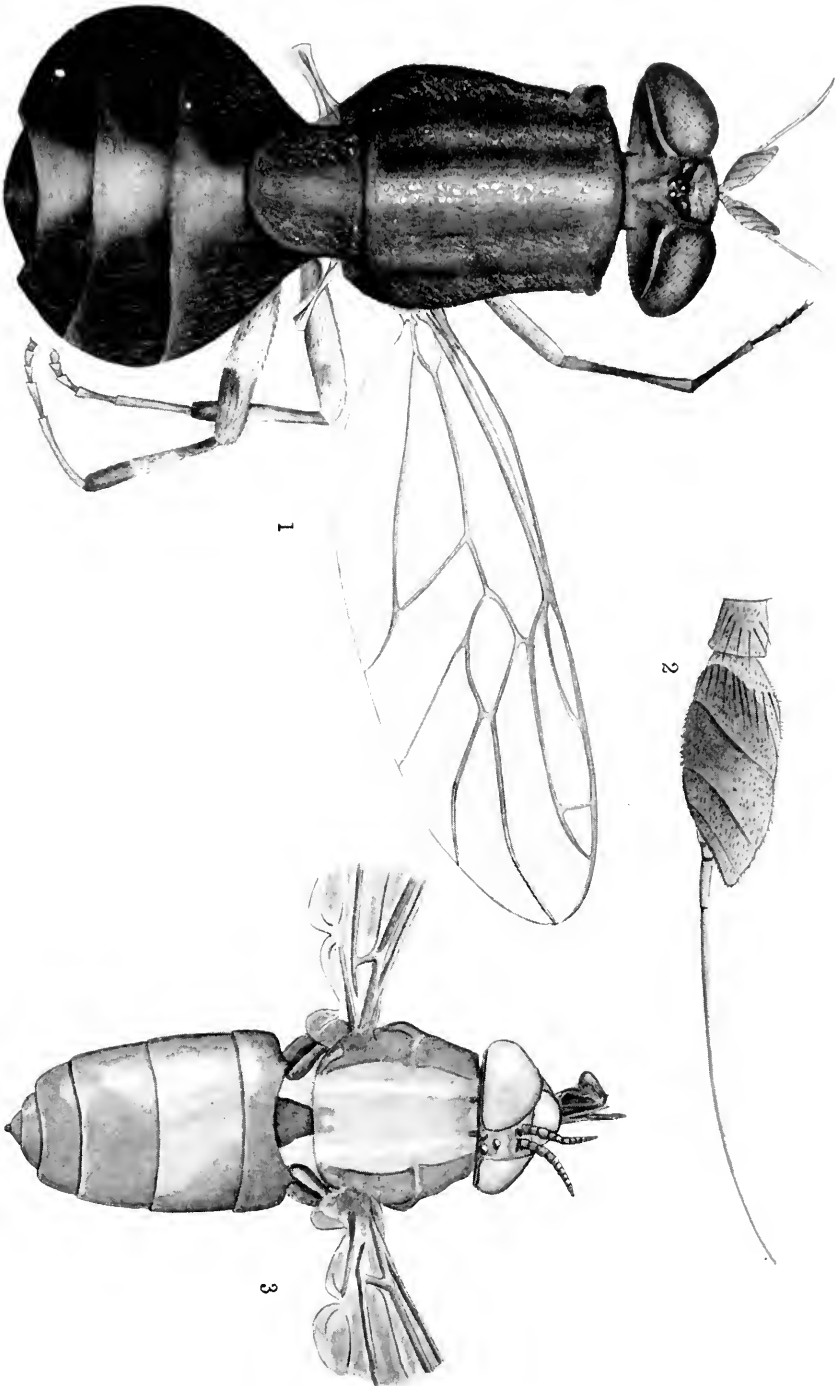


EXPLANATION OF PLATE XXXVI.

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- Fig. 1. *Dochmiocera aurilineata* n. gen. and sp. Dorsal view.  
.. 2.           ..           ..           ..           Antennæ.  
.. 3. *Pelecorhynchus fulvus* Ricardo. The allotype male.









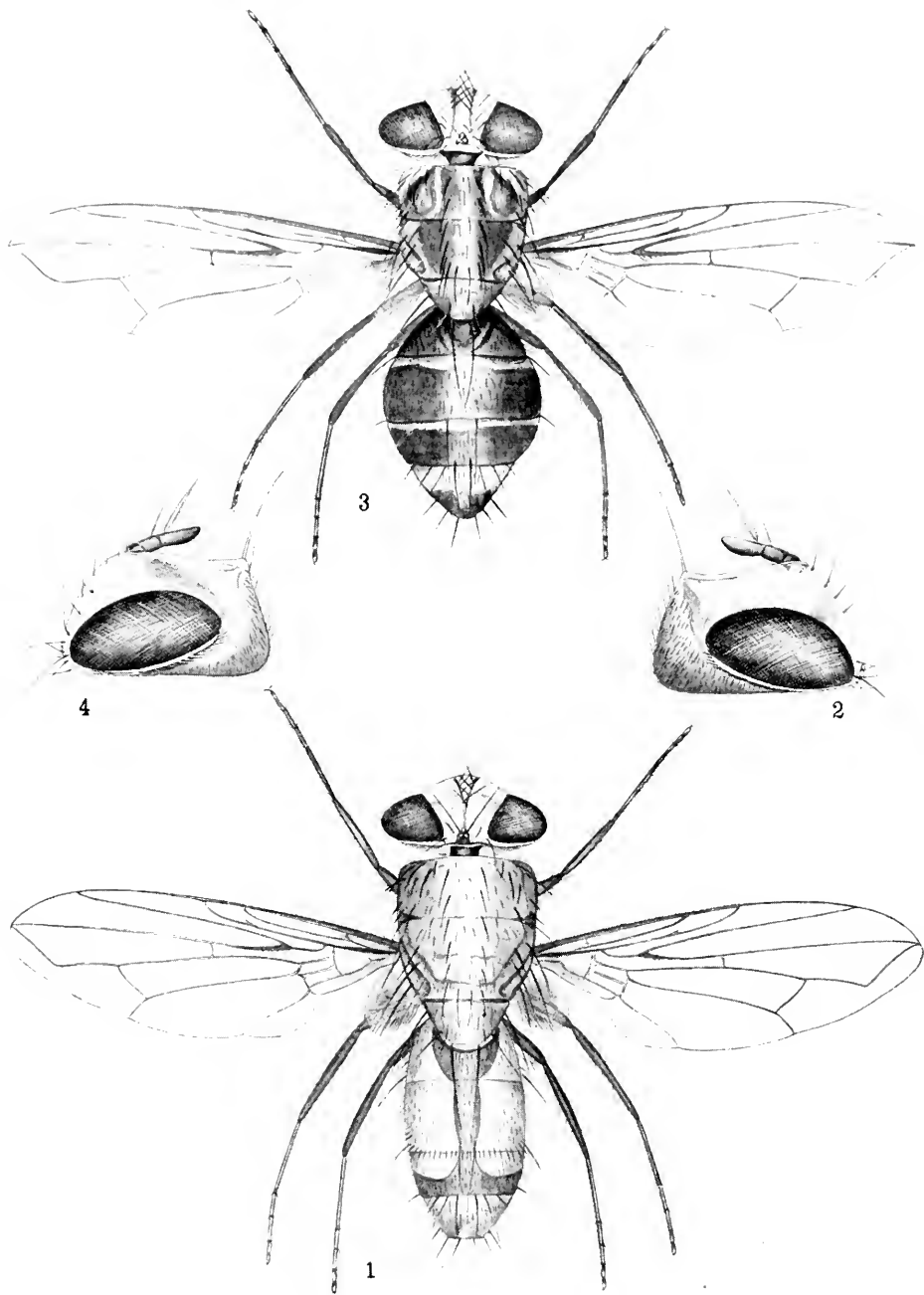
EXPLANATION OF PLATE XXXVII.

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*Heterometopia argentea* Macquart.

- Fig. 1. The male.  
.. 2. The side view of the head of the male.  
.. 3. The female.  
.. 4. The side view of the head of the female.
- 

NOTE.—Figs. 2 and 4 were inadvertently drawn to face the same direction as figs. 1 and 3.





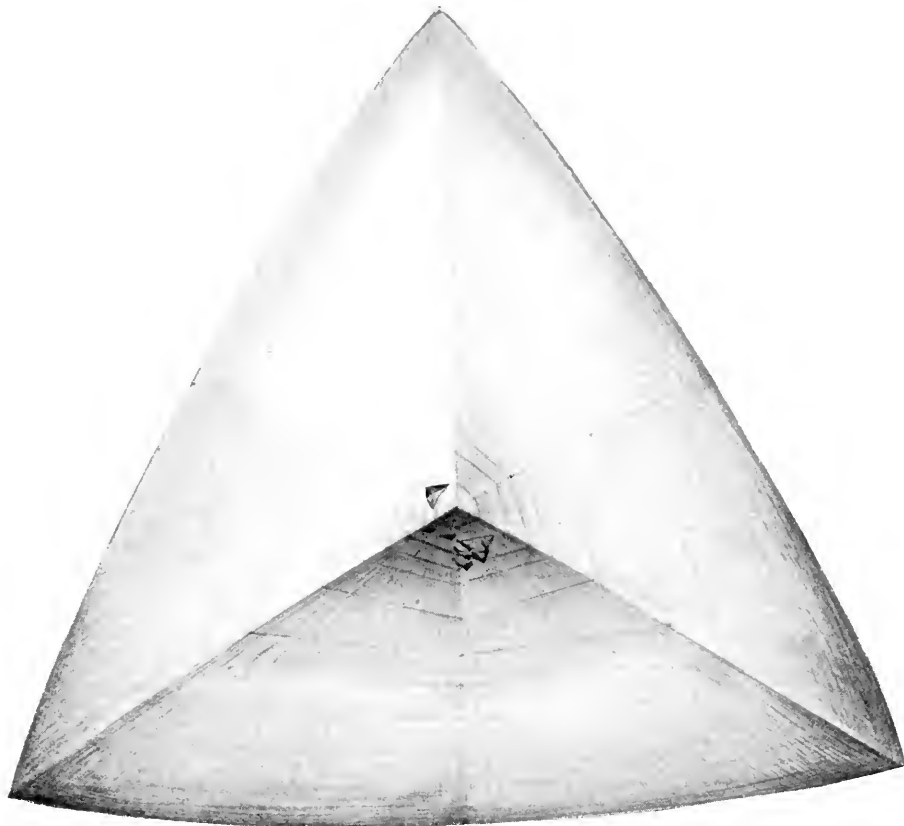


EXPLANATION OF PLATE XXXVIII.

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- Fig. 1. Diamond, Boggy Camp, Inverell, N. S. Wales; twin on (111), flattened parallel to twin plane.
- Fig. 2. Anglesite, Dundas, Tasmania; large broken crystal; about half natural size.
- Fig. 3. Anglesite, Dundas, Tasmania; group of crystals; about natural size.





1



2

3





EXPLANATION OF PLATE XXXIX.

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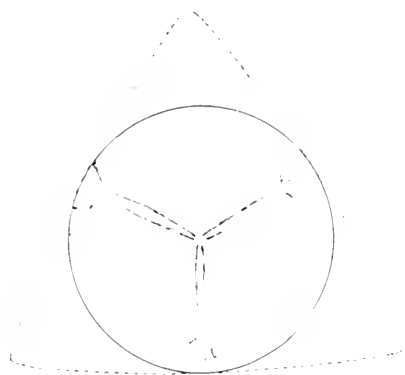
Fig. 1. Diamond, Boggy Camp, Inverell, N. S. Wales; light paths in stereographic projection; dotted outline shows orientation of the crystal.

Figs. 2-6. Anglesite, Dundas, Tasmania.

Forms:— $c$  (100),  $a$  (100),  $m$  (110),  $n$  (120),  $o$  (011),  $d$  (102),  
 $l$  (104),  $r$  (112),  $z$  (111),  $\tau$  (221),  $y$  (122), (368),  
 $p$  (324).

Fig. 7. Pyrite, Mt. Stewart, near Leadville, N. S. Wales.

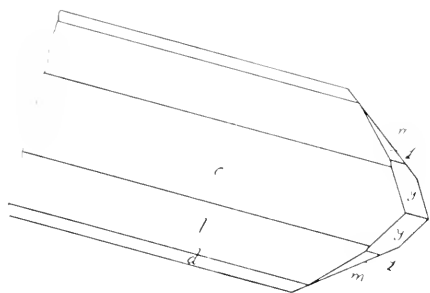
Forms:— $a$  (100),  $e$  (021),  $o$  (111),  $s$  (213).



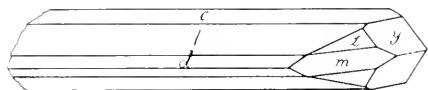
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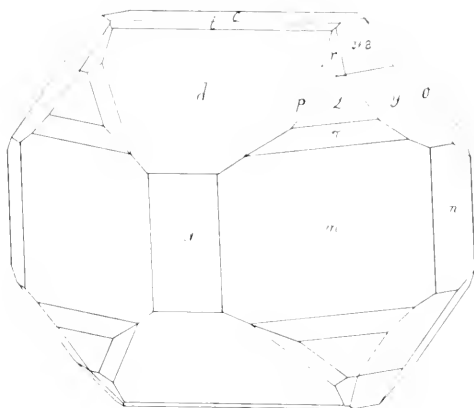
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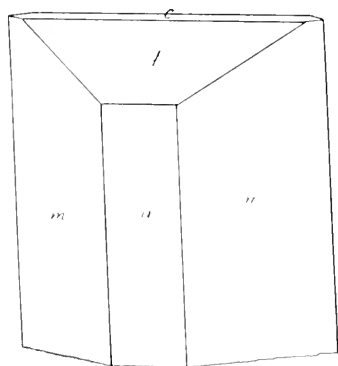
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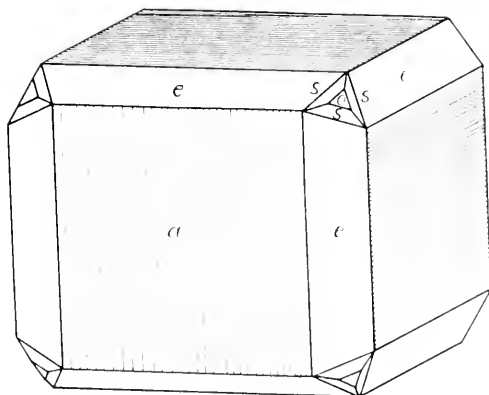
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4



7





EXPLANATION OF PLATE XL.

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Figs. 1, 2. Anglesite, C.S.A. Mine, Cobar, N. S. Wales.

Figs. 3, 4. Anglesite, Mt. Stewart, near Leadville, N. S. Wales.

Forms:—*r* (001), *u* (100), *m* (110), *o* (011), *l* (104), *d* (102),  
*z* (111), *y* (122), *μ* (124).

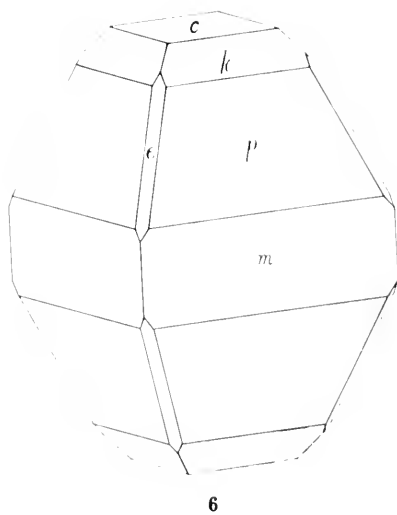
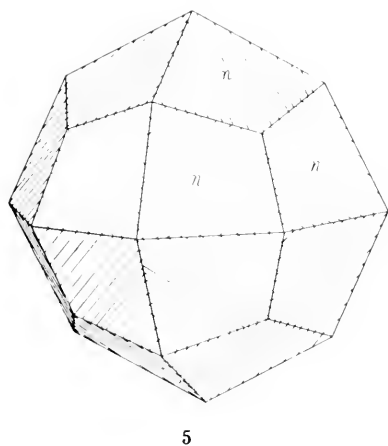
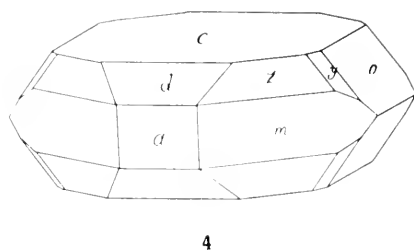
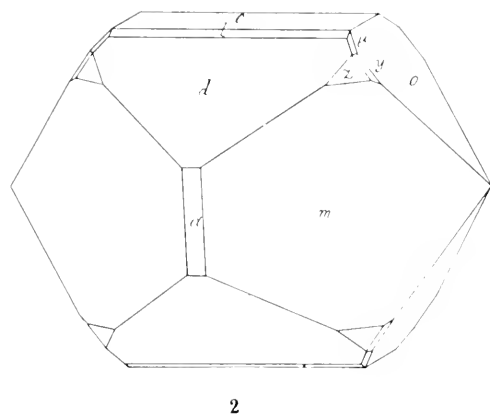
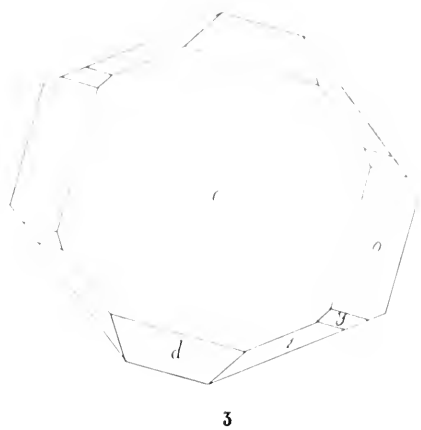
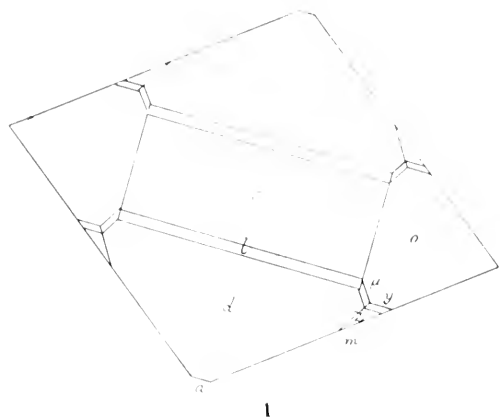
Fig. 5. Garnet, Junction North Mine, Broken Hill, N. S. Wales.

Forms:—*l* (101), *u* (112), *s* (123).

Fig. 6. Anatase, Wild Kate Mine, Deepwater, N. S. Wales.

Forms:—*r* (001), *m* (110), *v* (011), *p* (111), *k* (112).









EXPLANATION OF PLATE XL.

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Fig. 1. Sulphur, Hot Lakes District, N. Zealand.

Fig. 2. Sulphur, Tanna, New Hebrides.

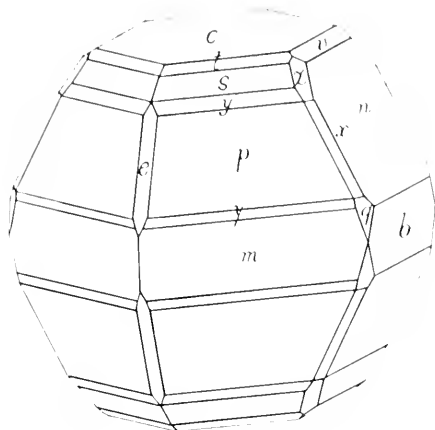
Forms:— $c$  (001),  $b$  (010),  $m$  (110),  $e$  (101),  $u$  (011),  $v$  (013),  
 $t$  (115),  $s$  (113),  $y$  (112),  $p$  (111),  $\gamma$  (331),  $z$  (135),  
 $x$  (133),  $q$  (131).

Figs. 3, 4. Sphalerite, Spring Creek, Bungonia, N. S. Wales; a pseudo-hexagonal twin on (111).

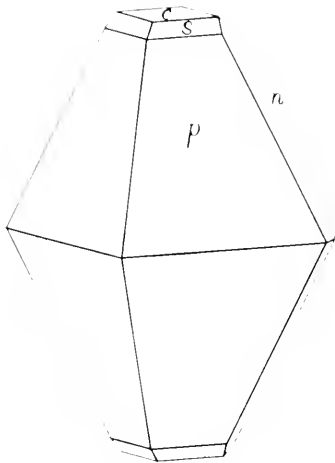
Forms:— $d$  (101),  $o$  (111).

Fig. 5. Azurite, Cobar Gladstone Mine, Cobar, N. S. Wales.

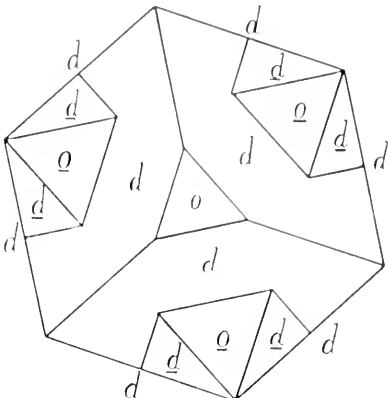
Forms:— $c$  (001),  $a$  (100),  $m$  (110),  $l$  (023),  $p$  (021),  $\sigma$  (101),  
 $\theta$  (101),  $\eta$  ( $\bar{3}$ 02),  $h$  (221),  $P$  (223),  $x$  (111),  $k$  ( $\bar{2}$ 21),  
 $R$  ( $\bar{2}$ 41),  $v$  (245),  $\rho$  (134).



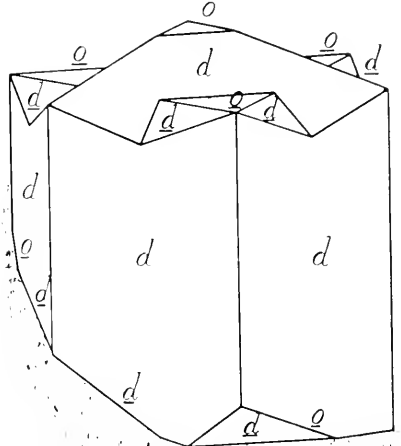
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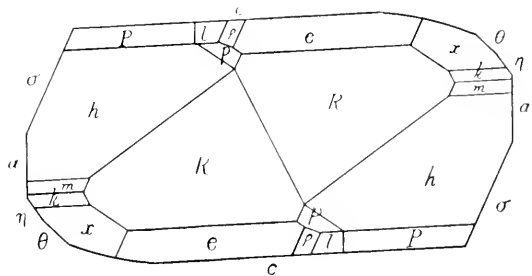
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4



5



## A REVISION OF THE AUSTRALIAN *TURRIDÆ*.

BY

CHARLES HEDLEY.

(Plates xlii.-lvi.)

The marine gasteropods embraced in the family *Turridæ* (formerly *Pleurotomidæ*) are considered by those who meddle with them to be more perplexing than any other molluscan family. This is because that family embraces a bewildering wealth of recent and fossil species, frequently small in size, variable or indistinct in feature, and from depths difficult of access. For the most part the species are expressed by a poverty of individuals. This small proportion of individuals to a species is the general rule with carnivora, which by ecological harmony must be less numerous in individuals than the phytophaga. But the consequent scarcity of specimens hinders that exchange and comparison of material between students, so necessary for the correction of error and advance of knowledge. The range of Turrid species in space appears to be rather narrow.

Our knowledge of the Australian *Turridæ* is still very incomplete. The fauna of eastern Australia from Hobart to Torres Strait is best represented in this paper; that of the north and west is scarcely known at all; that of the south coast has been elaborated in excellent papers by Sir Joseph Verco.

Re-arrangement of species and genera to conform with modern taxonomy has rejected such old friends as *Pleurotoma*, *Drillia*, *Mangelia*, *Glyphostoma*, *Clathrella*, *Cythara*, and *Bela*, so that *Diplomella* alone survives of the generic names used in this group for our fauna by the last generation of conchologists.

About three hundred and seventy recent species discussed in the following pages are divided into four sub-families. First are the *Turritinae*, distinguished by a narrow magniculate operculum with an apical nucleus. As this feature is not always available for study, it is useful to note that the nuclear whorl is comparatively large and almost as broad as the rest of the protoconch, and that the interior of the shell is often fluted.

An operculum with a medio-lateral nucleus is held to be the distinguishing feature of the sub-family *Clacatulinae*.

Those genera are assigned to the sub-family *Mangiliinae*, in which the protoconch is helicoid, with a very small initial, and rapidly increasing subsequent whorls. Here the texture of the adult shell is frequently "gritty," from a sculpture of minute grains; the varix is usually well developed, and the fasciole evanescent. A series of pustules on the columella is an ordinary feature. The operculum is said to be missing.

An elaborately sculptured protoconch contrasts with the smooth protoconch of previous groups, and gives ready recognition to the fourth family—the *Diplomellinae*.

I have to thank the Trustees of the Macleay Museum, University of Sydney, for the loan of the Turrids taken by the Chevert Expedition, and the Council of the Linnean Society of New South Wales for permission to reprint some text figures.

*Family* TURRIDÆ.

*Sub-family* TURRINÆ.

*TURRIS* Müller.

*Turris* Müller, Delic. Nat. Selectæ, i., 1766, p. 129, type *Murex babylonius* Linne. *Id.* Bolten, Mus. Bolt. 1798, p. 123. *Id.* Dall Proc. U. S. Nat. Mus., liv., 1918, p. 332.

*Pleurotoma* Lamarek, Mem. Soc. Nat. Hist. Paris, 1799, p. 73.

*Lophiotoma* Casey, Trans. Acad. Sci. St. Louis, xiv., 1904, p. 130.

*Turris* is a strictly tropical genus. The shell is large, with a tall slender spire; outer lip sharp, without fold or thickening; the notch is a deep slit with parallel sides following a walled-in fasciole; within the body whorl are sharp raised revolving threads (Pl. xlii., fig. 1), a feature shared by related genera. Protoconch of two smooth rounded whorls (Pl. xlii., fig. 3). Operculum unguiculate, with apical nucleus. The animal has been figured by Quoy and Gaimard,<sup>1</sup> and by Gould.<sup>2</sup>

The species catalogued by Brazier<sup>3</sup> as *Pleurotoma brevicaudata* is not that, but is described in this paper as *Turridrupa deceptrix*. What the same writer considered to be *Pleurotoma punctata* (*op. cit.*, p. 151) is here recorded as *Gemmula graeffei*; and what Brazier catalogued as *P. jubata* and *P. armillata* are here included under *Turridrupa acutigemmata* Smith.

From the Australian Tertiary the following fossils have been described by Harris—*Turris optata*, *salebrosa*, *septemlicata*, *subconcarva*, and *trilicata*.

*TERRIS BABYLONIA* Linne.

(Pl. xlii., fig. 1.)

*Murex babylonia* Linne, Syst. Nat., x., 1758, p. 753. *Id.* Knorr, Conchilien, iv., 1789, p. 403, pl. xiii., fig. 2. *Id.* Hanley, Ips. Linn. Conch., 1855, p. 299.

*Pleurotoma babylonia* Weinkauff, Conch. Cab., 1875, p. 10, pl. i., figs. 4, 5. *Id.* Tapparone Canefri, Bull. Soc. Zool. France, ix., 1878, p. 246. *Id.* Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p. 101. *Id.* Schepman, Siboga Exped. Mon., xlix., 1913, p. 398. *Id.* Bonge and Dautzenberg, Journ. de Conch., xli., 1914, p. 125.

*Buccinum coelatum* Martyn, Univ. Conch., ii., 1789, pl. xciv.

*Pleurotoma renusta* Reeve, Conch. Icon., i., 1843, pl. ix., fig. 79.

*Hab.* Queensland:—Cairns (Shirley).

<sup>1</sup> Quoy and Gaimard—Astrolabe Zoologie, Pl. xxxv., fig. 4.

<sup>2</sup> Gould—Moll. U. S. Explor. Exped., Pl. xviii., fig. 311.

<sup>3</sup> Brazier—Proc. Linn. Soc. N.S.Wales, i., 1876, p. 152.



TERRIS CRISPA *Lamarek.*

*Pleurotoma crispa* Lamarek, Encycl. Meth. Vers., 1816, pl. cccxxxix., fig. 4, and An. s. vert., vii., 1822, p. 95. *Id.* Kiener, Coq. Viv., 1840, p. 8, pl. ii., fig. 1. *Id.* Reeve, Conch. Icon., i., 1843, pl. ii., fig. 11. *Id.* Weinkauff, Conch. Cab., 1875, p. 9, pl. i., figs. 1, 2. *Id.* Brazier, Proc. Linn. Soc. N.S.Wales, ii., 1877 (1878), p. 368. *Id.* Schepman, Siboga Exped. Mon., xlix., 1913, p. 398.

*Pleurotoma grandis* Griffiths and Pidgeon, Mollusca, 1833, p. 599, pl. xxiii., fig. 1. *Id.* Reeve, Conch. Icon., i., 1843, pl. ii., fig. 13. *Id.* Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p. 101.

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier); 10 fathoms, Mapoon, Gulf of Carpentaria (self).

TERRIS INDICA *Bolten.*

*Turris indica* Bolten, Mns. Bolt., 1798, p. 124 for Conch. Cab., iv., pl. cxlv., figs. 1345-6. *Id.* Melvill, Proc. Malac. Soc. xii., 1917, p. 143. (not *Pleurotoma indica* Deshayes, in Belanger Voy. Indes Orient. Zool., 1833, p. 95).

*Pleurotoma marmorata* Lamarek, An. s. vert., vii., 1822, p. 95 (not *P. marmorata* Lamarek, 1816, q.v.). *Id.* Blainville, Diet. Sci. Nat. Meth., xli., 1826, p. 385. *Id.* Gray, Zool. Beechey Voy., 1839, p. 119, pl. xxxiv., fig. 9. *Id.* Kiener, Coq. Viv., 1840, p. 9, pl. vi., fig. 1, pl. vii., fig. 2. *Id.* Reeve, Conch. Icon., i., 1843, pl. iii., fig. 216. *Id.* Schmeltz, Mus. Godeffroy, Cat., iv., 1869, p. 90. *Id.* Brazier, Proc. Linn. Soc. N.S.Wales, ii., 1877 (1878), p. 36. *Id.* Smith, Proc. Zool. Soc., 1879, p. 186. *Id.* Watson, Chall. Rep. Zool., xv., 1886, p. 277. *Id.* Smith, Ann. Mag. Nat. Hist. (6), xvi., 1895, p. 263. *Id.* Sturany, Pola Exped. Moll., 1903, p. 228, pl. iv., fig. 1. *Id.* Schepman, Siboga Exped. Mon., xlix., 1913, p. 399. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 128.

*Pleurotoma neglecta* Reeve, Conch. Syst., ii., 1842, p. 189, pl. cccxxv., fig. 2.

*Pleurotoma hastula* Reeve, Conch. Icon., i., 1843, pl. xvii., fig. 139.

*Hab.* Queensland:—25 fathoms, Darnley Island (Brazier); Cape York ("Challenger"). Northern Territory:—Darwin (Spencer).

TERRIS MARMORATA *Lamarek.*

(Plate xlii., figs. 2-3.)

*Pleurotoma marmorata* Lamarek, Encycl. Meth., 1816, pl. cccxxxix., fig. 6, expl. pl. p. 8 (not *P. marmorata* Lamarek, An. s. vert., vii., 1822, p. 95 = *T. indica* Bolten).

*Pleurotoma albina* Lamarek, An. s. vert., vii., 1822, p. 96. *Id.* Gray, Zool. Beechey Voy., 1839, p. 120, pl. xxxiv., fig. 4. *Id.* Kiener, Coq. Viv., 1840, p. 11, pl. xv., fig. 1.

*Pleurotoma peaseana* Dunker, Malak. Blatt., xviii., 1871, p. 158. *Id.* Weinkauff, Conch. Cab., 1876, p. 69, pl. xv., figs. 1, 3.

*Pleurotoma jickelii* Weinkauff, Conch. Cab., 1875, p. 20, pl. iv., figs. 2, 3.

*Pleurotoma tigrina* Potiez and Michaud, Galerie Moll. Mus. Donai, i., 1838, p. 448. *Id.* Brazier, Proc. Linn. Soc. N.S.Wales, ii., 1877 (1878), p. 368.

*Turris acuta* Hedley, Proc. Linn. Soc. N.S.Wales, xxxii., 1907, p. 484.

? *Lophiotoma microsticta* Casey, Trans. Acad. Sci. St. Louis, xiv., 1904, p. 130.

Thus I have identified a shell which is common along the east coast of tropical Queensland, both in the muddy estuary and off coral reefs. In life it is clothed in a thick fibrous epidermis which, as in my figure, hides the colour pattern of the shell beneath. The size and density of the brown dots vary. Some difference in proportion also occurs, thus a stout specimen from Hope Island is 42 mm. long and 13 mm. broad, but a slender specimen from Cape Flattery is 40 mm. long and 10 mm. broad. A shell 30 mm. in length which I dredged alive at the entrance of the Stareke River is here illustrated (Pl. xlii., fig. 2). Another (Pl. xlii., fig. 3) dredged in 3 fathoms off Eagle Island, North Queensland, exhibited the following features:—Apex mucronate, of two smooth and glossy whorls, followed by whorls bearing a strong subsutural ridge and a double peripheral keel. The upper four whorls are distinguished by a uniform cinnamon brown from the white remainder of the shell.

The confusion of nomenclature applied to this species was in the first instance probably due to the blindness of Lamarek, whereby the names of different species were displaced. Thus the shell named *Pleurotoma marmorata* in 1822 was different to what he had figured under that name in 1816. Blainville<sup>4</sup> was the first to observe the transposition. Brazier, who was the first to note this as an Australian species, used for it the name of *Pleurotoma tigrina*; but, according to Kiener's figure of authentic material, *P. tigrina* differs by its broader build and particularly by the occurrence of spiral threads within the fasciole. Subsequently, following a reference by Deshayes,<sup>5</sup> I called the species *Turris acuta*. On reconsideration, the shell figured as *acuta* by Perry<sup>6</sup> seems to differ in shape from *T. tigrina*, and to approach that of *Gemma granosa* Helbling. Deshayes further suggested that *Pleurotoma punctata* of Schubert and Wagner might be united to *T. tigrina*, but I should prefer to regard that as identical with *Pleurotoma nudo* Kiener.

*Hab.* Queensland:—30 fathoms, Daruley Island; 14 fathoms, Princess Charlotte Bay (Brazier); Murray Island; Stareke River; Lizard Island; Eagle Island; Cape Flattery; Hope Island; Palm Island; Mast Head Reef (self).

<sup>4</sup> Blainville—Diet. Sci. Nat. Meth., xli., 1826, p. 385.

<sup>5</sup> Deshayes—Anim. sans. vert., (2), ix., 1843, p. 352.

<sup>6</sup> Perry—Conchology, 1811, Pl. liv., fig. 4.

TURRIS SPECTABILIS *Reeve*.

*Pleurotoma spectabilis* Reeve, Conch. Icon., i., 1843, pl. i., fig. 6. *Id.* Brazier, Proc. Linn. Soc. N.S.Wales, ii., 1877 (1878), p. 368.

*T. spectabilis* and *T. garrauxi* Reeve, form a pair differing in the length of the canal. Similar pairs are *T. tigrina* Lamk, and *T. abbreviata* Reeve; *T. maculorata* Lamk, and *T. cingulifera* Lamk.

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier).

TURRIS UNDOSA *Lamarek*.

*Pleurotoma undosa* Lamarek, Encycl. Meth. Vers., 1816, pl. cccxxxix., fig. 5, and Anim. s. vert., vii., 1822, p. 95. *Id.* Reeve, Conch. Icon., i., 1843, pl. iii., fig. 18. *Id.* Watson, Chall. Rep. Zool., xv., 1886, p. 279.

*Hab.* Queensland:—Albany Passage ("Challenger").

GEMMULA *Weinkauff*.

*Gemmula* Weinkauff, Jahrb. deutsch. malak. Gesell., ii., 1876, p. 287. *Id.* Cossman, Essai Paleconch. Comp., i., 1896, p. 62. Type *Pleurotoma gemmata* Reeve.

Weinkauff proposed *Gemmula* as a sub-genus for the reception of *carinata* Gray, *speciosa* Reeve, *monilifera* Pease, *gemmata* Reeve, *graeffei* Weinkauff, and *anabilis* Weinkauff. From these Cossmann selected *gemmata* as type. It may be here observed that *gemmata* should be ascribed to Reeve, not, as is usual, to Hinds, for Reeve published it in April, 1843, and Hinds in October, 1843.

The bead-row of the fasciole readily distinguishes this genus from related forms. Between the smooth protoconch and the adult whorls two or three whorls intervene with discrepant sculpture of fine arcuate longitudinal riblets.

The genus is perhaps represented in the Australian Tertiary by *Pleurotoma sayceana* Chapman.<sup>7</sup>

GEMMULA GRAEFFEI *Weinkauff*.

*Pleurotoma punctata* Brazier, Proc. Linn. Soc. N.S.Wales, i., 1876, p. 151 (not *P. punctata* Reeve).

*Pleurotoma (Gemmula) graeffei* Weinkauff, Jahrb. deut. malak. Gesell., ii., 1876, p. 290, pl. ix., figs. 9, 10. *Id.* Weinkauff, Conch. Cab., 2 ed., ix., 1876, p. 71, pl. iii., figs. 9, 10.

On the identification of a friend, I reported<sup>8</sup> this as *Turris granosus* Helbling, but on re-examination of the material I now regard this Queensland shell as *G. graeffei*.

*Hab.* Queensland:—20 to 30 fathoms, Darnley Island (Brazier); 5 to 8 fathoms, Cairns Reef (self).

<sup>7</sup> Chapman—Proc. Roy. Soc. Vict., xxv., 1912, p. 191, Pl. xii., fig. 7.

<sup>8</sup> Helley—Proc. Linn. Soc. N.S.Wales, xxxiv., 1909, p. 453.

GEMMULA HOMBRONI *nom. nov.*

*Pleurotoma fusca* Hombron and Jacquinot, Voy. Pole sud. Zool., iv., 1853, p. 111, pl. xxv., figs. 19, 20. *Id.* Smith, Proc. Zool. Soc., 1879, p. 186, and Ann. Mag. Nat. Hist. (7), xiii., 1904, p. 456. *Id.* Sturany, Denks. Math. Nat. K. Akad. Wiss. Wien., lxxiv., 1903, p. 229, pl. iii., fig. 3. *Id.* Schepman, Siboga Exp. Mon., xlix., 1913, p. 402. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 144. (Not *Pleurotoma fusca* C. B. Adams, Proc. Bost. Soc. Nat. Hist., ii., 1845, p. 4.)

*Hab.* Queensland:—Torres Strait (type, Hombron and Jacquinot).

## GEMMULA MONILIFERA Pease.

*Pleurotoma monilifera* Pease, Am. Journ. Conch., 1870, p. 68. *Id.* Wein-kauff, Jahrb. deut. malak. Gesell., ii., 1876, p. 289, pl. ix., figs. 1, 3.

*Pleurotoma gemmata* Brazier, Proc. Linn. Soc. N.S.Wales, i., 1876, p. 151 (not *Pleurotoma gemmata* Reeve).

*Hab.* Queensland:—11 fathoms, Darnley Island (Brazier); 5 to 8 fathoms, Murray Island (self).

## ASTHENOTOMA Harris and Burrows.

*Asthenotoma* Harris and Burrows, Eocene and Oligocene Beds of Paris Basin, 1891, p. 113, *nom. nov.* for *Oligotoma* Bellardi, preocc. *Id.* Cossmann, Essai Paleococonch. Comp., ii., 1896, p. 104. *Id.* Sacco, Moll. Terr. Piemonte, xxx., 1904, p. 51. *Id.* Dall, Proc. Nat. Mus., liv., 1918, p. 322.

*Oligotoma* Bellardi, Mem. Acad. Roy. Sci. Turin (i.), xxix., 1875, p. 235, type *Pleurotoma basteroti* Desmoulins. *Id.* Jousseaume, Bull. Soc. Zool. France, viii., 1883, p. 197. *Id.* Cossmann, Cat. Illustr. Coq. Foss. Paris, iv., 1889, p. 255 (not *Oligotoma* Westwood, Trans. Linn. Soc., xvii., 1836, p. 373).

*Microdrillia* Casey, Proc. Acad. Nat. Sci. Philad., lv., 1903, p. 276, type *Pleurotoma cossmanni* Meyer.

*Tomopleura* Casey, Trans. Acad. Sci. St. Louis, xiv., 1904, p. 138, type *Pleurotoma nicea* Philippi.

*Asthenotoma* is founded on a Miocene fossil, *Pleurotoma basteroti* Desmoulins,<sup>9</sup> which is co-generic, as Jousseaume has explained, with certain recent Indo-Pacific shells. It appears to me to be nearly related to *Turris*, with which spiral ridges deep within the throat and a smooth mucronate apex associate it. From *Turris* it differs by smaller size, bent columella, very short and upturned canal, a widely gaping instead of a linear notch, and by the radial sculpture. The operculum in a specimen of *A. nicea* Philippi, dredged at Karachi, and kindly given to me by Dr. J. C. Melvill, is oblong with a subterminal nucleus (Pl. xlii., fig. 4).

From the Australian Tertiary, Professor Tate<sup>10</sup> has noted *Asthenotoma tatei* Cossmann, and *Pleurotoma consutilis* Tenison Woods.

<sup>9</sup> Desmoulins. Act. Linn. Soc. Bordeaux, xii., 1842, p. 156.

<sup>10</sup> Tate. Proc. Roy. Soc. N.S.Wales, xxi., 1898, p. 398.

*ASTHENOTOMA CICATRIGULA* sp. nov.

(Plate xlii., fig. 5.)

Shell lanceolate, rather small and solid. Colour buff, sometimes suffused with violet; interior pale purple. Whorls eleven, including a mucronate protoconch of two and a half smooth whorls. Sculpture:—On the penultimate are five elevated and polished spiral keels, and on the last whorl there are seventeen, including five on the snout; except the protoconch and snout the whole shell is over-run by fine close curved radial threads, which are interrupted by the spirals. Fasciole well marked, half its breadth below the suture; from a median spiral thread the contained radials are disposed in chevron. Lip simple, its edge toothed by the external keels; notch deeply incised, widely gaping; lower limb more horizontal than the upper. Inner lip a thin smear, no tubercle at its insertion. On the inside of the lip are six entering raised spiral threads, which stop short of the edge. Length 15 mm., breadth 5 mm.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); 10 fathoms, Mapoon; 15 fathoms, Palm Islands; 5 to 10 fathoms, Hope Islands; Barney Point, Port Curtis (self). A specimen in the Macleay Museum is labelled Ovalau, Fiji.

*ASTHENOTOMA COGNATA* Smith.

(Figure 1.)

*Pleurotoma cognata* Smith, Ann. Mag. Nat. Hist., (4), xix., June 1877, p. 490. *Id.* Hedley, Proc. Linn. Soc. N. S. Wales, xxxiii., 1908, p. 487, pl. x. *bis.*, fig. 2. *Id.* Shirley, Proc. Roy. Soc. Queensland, xxiii., 1911, p. 101.

? *Oligotoma poulansis* Jousseanne, Bull. Soc. Zool. France, viii., 1883, p. 199, pl. x., fig. 9. *Id.* Melvill and Standen, Proc. Zool. Soc., 1901, p. 434.

By its stronger and more distinct spirals this species is readily distinguished from *Asthenotoma subtilinea*.

*Hab.* N. S. Wales:—Woolgoolga (Laseron); Ballina (Lower). Queensland:—Burleigh Heads (Shirley); Caloundra (Gross); Bustard Head (Pulleine); Facing Island, Port Curtis (Kesteven).



Fig. 1.

*ASTHENOTOMA SUBTILINEA* Hedley.

(Plate xlii., fig. 6.)

*Pleurotoma violacea* Angus (not Hinds), Proc. Zool. Soc., 1871, p. 92.

? *Pleurotoma vertebra* var. *albida* Bouge and Dautzenberg, Jour. de Conch., lxi., 1914, p. 132.

*Asthenotoma subtilinea* Hedley, Journ. Roy. Soc. N. S. Wales, li., 1918, p. M 82.

The shell now discussed was first recorded by Angus from Broken Bay, New South Wales, under the title of *Pleurotoma violacea* Hinds, but

that name was invalid because Adams and Mighels, of Boston, had employed it two years before Hinds.<sup>11</sup> In consequence Adams, in 1850,<sup>12</sup> offered *Pleurotoma reerei* to replace the second *Pleurotoma violacea*. Unfortunately for this proposal, Bellardi<sup>13</sup> had already engaged the name *Pleurotoma reerei* for an Italian fossil. It has been suggested that *Pleurotoma nirea* Philippi<sup>14</sup> applied to *Pleurotoma violacea* Hinds, but that Formosan shell has not been figured, and the identification is uncertain. A recent revision by Messrs. Bonge and Dautzenberg<sup>15</sup> of this species, or group of species, unites under *Pleurotoma vertebrata* Smith<sup>16</sup> all the species above mentioned, together with *Oligotoma makimomos* Jousseaume.<sup>17</sup>

Contrasting the Sydney shell with the figure of that which was dredged by H.M.S. "Sulphur," in the Strait of Macassar, considerable difference appears. The purple colour of *Pleurotoma violacea* does not occur on ours. The Malayan shell is shown with a concave profile, a slender tapering summit, an inflated body whorl and a produced canal—which features do not match our shell. It is suggested that these are different species. Japanese specimens of *Pleurotoma vertebrata* are smaller, more slender, more coarsely sculptured, and coloured differently to *Asthenotoma subtilinea*. In size and general appearance our shell agrees with *Oligotoma makimomos* Jousseaume, but has finer and more numerous spirals. Under these circumstances its identity is best preserved by describing it as distinct.

Shell rather large and solid, cylindro-conic, tapering evenly. Colour uniform grey. Whorls ten. Sculpture:—On the penultimate are five larger and five smaller spirals; on the last whorl are twenty-five spirals, of which seven are on the snout, besides uncounted threads, one in each of the broader furrows; numerous close-set radial threads lattice the spaces between the main spirals, but do not cross them; three spirals run along the fasciole, the outer rows of radial bars there contained are set in chevron. Aperture pyriform, outer lip simple; notch on the shoulder, rather deeply incised; canal short; columella sharply bent below. Length 22 mm., breadth 8 mm.

*Hab.* N. S. Wales:—Port Jackson (type); Port Stephens (old coll.); 8 fathoms, Green Point, Watson's Bay (Brazier). Queensland:—20 to 27 fathoms, off Mast Head Reef (self); beach at mouth of Annam River (self).

#### *FILODRILLIA* *gen. nov.*

*Filodrillia* is a group from deep water which resembles *Etrema* in the form of the sinus, but not of the protoconch, but differs in the thin slender shell, turreted whorls, absence of ribs and varix. Spiral sculpture predominates.

Type *Drillia tricarinata* Tenison-Woods.

*Pleurotoma albulu* Hutton, represents this genus in New Zealand, and *Pleurotoma dilectoides* Chapman and Gabriel, in the Australian Tertiary.

<sup>11</sup> Hinds.—Proc. Boston Soc. Nat. Hist., i., 1844, p. 50.

<sup>12</sup> Adams.—Contributions to Conchology, 1850, p. 54.

<sup>13</sup> Bellardi.—Monogr. Pleurot., 1847, p. 55, pl. iii., fig. 20.

<sup>14</sup> Philippi.—Zeit. f. Malak., viii., 1851, p. 92.

<sup>15</sup> Bonge and Dautzenberg.—Journ. de Conch., lxi., 1914, p. 130.

<sup>16</sup> Smith.—Proc. Zool. Soc., 1879, p. 186, pl. xix., fig. 6.

<sup>17</sup> Jousseaume.—Bull. Soc. Zool. France, viii., 1883, p. 198, pl. x., fig. 4.

*FILODRILLIA COLUMNARIA* sp. nov.

(Plate xlii., fig. 7.)

Shell slender elongate-fusiform. Colour buff, with a pale peripheral zone underlined by an orange band. Whorls seven and a half, of which two constitute the protoconch, angled at the shoulder, flattened above and rounded beneath, excavate at the base. Sculpture:—No radials occur; the fasciole area is traversed by three or four fine close threads; the rest of the shell carries stronger cords, uniform in size and evenly spaced; of these there are seven on the penultimate and twenty-two on the last whorl. Aperture open, right insertion ascending above the plane of the suture; a slight varix behind the aperture; outer edge of the expanded lip denticulate by the spiral sculpture, inner lip a thin sheet of callus; sinus deep, spout shaped; canal short, open. Length 9.5 mm., breadth 3.3 mm.

This species has a slight resemblance to *Etrema denseplicata*, compared with which it is smaller, proportionately narrower, and devoid of radial sculpture.

*Hab.* Tasmania:—100 fathoms, Cape Pillar (type); 80 fathoms, Schouten Island (May).

*FILODRILLIA COSTICAPITATA* Verco.

*Drillia costicapitata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 296, pl. xxvii., figs. 1-2.

*Hab.* South Australia:—40 fathoms, Beachport (type, Verco).

*FILODRILLIA DILECTA* Hedley.

(Figure 2.)

*Drillia dilecta* Hedley, Mem. Austr. Mus., iv., 1903, p. 387, fig. 100, and Rec. Austr. Mus., vi., 1905, p. 42. *Id.* Verco, Trans. Roy. Soc. S. Australia, xxxiii., 1909, p. 306.

*Asthenotoma dilecta* May, Check-list Mollusca Tasmania, 1921, p. 77.

This species is represented in Kalimnan strata by *A. dilectoides* Chapman and Gabriel.<sup>18</sup>

*Hab.*—Port Stephens type, 111 fathoms, Cape Byron (Halligan). 50 fathoms, Cape Three Points; 80 fathoms, Narrabeen; 50 fathoms, Wata Mooli; 60 to 70 fathoms, Port Kembla ("Thetis"), New South Wales; 100 fathoms, Cape Wiles (self). 90 to 130 fathoms, Cape Jaffa; 104 fathoms, Neptune Island; 150 fathoms, Beechport (Verco), South Australia.

Var. *parabolo* Verco, Trans. Roy. Soc. S. Australia, xxxiii., 1909, p. 306.

*Hab.* South Australia:—90 fathoms, Cape Jaffa; 200 fathoms, Beachport (Verco).



Fig. 2.

<sup>18</sup> Chapman and Gabriel—Rec. Geol. Survey Victoria, iii., 4, 1916, p. 393.

FILODRILLIA DULCIS *Sowerby*.

*Daphnella dulcis* Sowerby, Proc. Malac. Soc., ii., 1896, p. 26, pl. iii., fig. 5.  
*Drillia dulcis* Vero, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 297.

*Hab.* South Australia :—15 to 20 fathoms, St. Vincent Gulf (type); 40 fathoms, Beachport (Vero); 35 fathoms, St. Francis Island (Vero). Tasmania :—100 fathoms, Cape Pillar (Hedley and May).

FILODRILLIA HASWELLI *Hedley*.

*Drillia haswelli* Hedley, Rec. Austr. Mus., vi., 1907, p. 297, pl. lv., fig. 22.

*Hab.* N.S.Wales :—80 fathoms, Narrabeen (type); 50 fathoms, Cape Three Points; 100 fathoms, Wollongong; 300 fathoms, Sydney (self).

FILODRILLIA HILUM *Hedley*.

*Mangelia hilum* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1908, p. 471, pl. ix., fig. 17. *Id.* Hedley and May, Rec. Austr. Mus., vii., 1908, p. 112. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxiii., 1910, p. 90.

*Hab.* N.S.Wales :—12 fathoms, Sydney (type, Brazier). Tasmania :—100 fathoms, Cape Pillar (May and Hedley). Victoria :—Wilson's Promontory ("Endeavour").

FILODRILLIA LACTEOLA *Vero*.

*Drillia lacteola* Vero, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 304, pl. xxvi., fig. 5. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxvi., 1913, p. 74.

*Hab.* South Australia :—90 fathoms, Cape Jaffa (type); 110 fathoms, Beachport; 62 fathoms, Cape Borda (Vero). Victoria :—40 fathoms, Ninety-mile Beach (Gatliff). Tasmania :—100 fathoms, Cape Pillar; 80 fathoms, Schouten Island (May).

Var. CREBRISIRIATA *Vero*.

*Vero op. cit.*

*Hab.* South Australia :—40 fathoms, Beachport (Vero).

Var. SIXUSIGENS *Vero*.

*Vero op. cit.*

*Hab.* South Australia :—100 fathoms, Beachport (Vero).

FILODRILLIA MUCRONATA *sp. nov.*

(Plate xlii., fig. 8.)

Shell elongate, fusiform. Colour uniform ivory-yellow. Whorls seven, of which two compose the protoconch. Sculpture :—Radials absent; on the shoulder a sharp angle is defined by a prominent cord, above which six fine and closely packed threads occupy the fasciole area; below this the cords as they descend become smaller and closer, those in the hollow of the base being the most crowded; there are twenty-two such cords on



the last whorl, and three or four on the upper whorls. Aperture:—Right insertion slightly mounting above the plane of the suture; the sinus a large U-shaped spout, below which is an incipient varix; beyond the latter the free limb of the outer lip bends inwards; within this lip are sometimes a few entering plications; inner lip a sheet of callus, thin above, but with a thickened margin below; canal short, expanding, and open. Length 9·5 mm., breadth 3·5 mm.

On first acquaintance I considered this to be a variety of *Filodrilla tricarinata*, but more material convinces me that it is distinct, because of a narrower protoconch, and finer, more numerous spirals.

*Hab.* N.S.Wales:—24 fathoms, Cabbage Tree Island, Port Stephens (type, Museum Expedition); 22 fathoms, Manning Heads ("Thetis"); 75 fathoms, Port Kembla ("Thetis"); 50 fathoms, Botany Heads ("Thetis"); 80 fathoms, Narrabeen (self).

*FILODRILLA ORNATA* *sp. nov.*

(Plate xlii., fig. 9.)

Shell small, rather solid, turreted, subcylindrical. Colour uniform buff. Whorls rounded, six, inclusive of the bulbous protoconch. Sculpture:—The flattened and conspicuous fasciole carries three or four small spiral threads; the remaining spirals are sharp cords, narrower than their interspaces, larger and wider apart on the periphery, about fifteen on the body whorl and five on the penultimate; radial riblets, so faint as to scarcely appear in the intercostal furrows, form beads on these spirals; these riblets are most developed on the fourth and fifth whorls, and vanish gradually on the last whorl. Aperture open, sinus wide and deep; inner lip with a thin callus; canal short and broad. Length 7·5 mm., breadth 3 mm.

*Hab.* Tasmania:—100 fathoms, Cape Pillar (type, May and Hedley).

*FILODRILLA RECTA* *Hedley.*

(Figure 3.)

*Leucosyrinx recta* Hedley, Mem. Austr. Mus., iv., 1903, p. 386, fig. 99. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxxvi., 1913, p. 74.

*Hab.* N. S. Wales:—75 fathoms, Port Kembla (type); 50 fathoms, Cape Three Points ("Thetis"); 50 fathoms, Botany Heads ("Thetis"). Victoria:—40 fathoms, Ninety-mile Beach (Gatliff). Tasmania:—80 fathoms, Schouten Island (May).

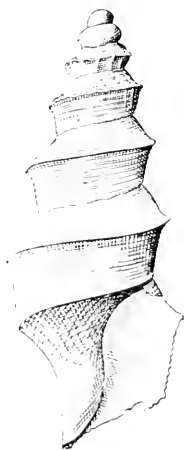


Fig. 3.

*FILODRILLIA STADIALIS* *sp. nov.*

(Plate xlii., fig. 10.)

Shell small, turreted, ovate-fusiform. Colour dull white, the glassy opaque protoconch contrasting with the dull texture of the rest of the shell. Whorls six, inclusive of a two-whorled protoconch, rather inflated, sharply angled at the shoulder. Sculpture:—Five fine close threads traverse the fasciole area: below the shoulder angle thirteen spaced cords become progressively smaller and closer towards the end of the shell, four of these ascending to the penultimate and two to the uppermost whorl; faint curved radial dashes start below the shoulder angle and vanish on the base. Aperture open, without varix; sinns broad and deep; canal short and open. Length 6.5 mm., breadth 3 mm.

Compared with its ally *P. ornata*, *P. stadialis* is a shorter, stouter shell, with a more elevated protoconch, fewer spirals, and fainter radials.

*Hab.* N. S. Wales:—100 fathoms, Wollongong (type); 80 fathoms, Narrabeen (self); 59 fathoms, Wata Mooli ("Thetis").

*FILODRILLIA STEIRA* *sp. nov.*

(Plate xlii., fig. 11.)

Shell small, solid, biconical. Colour uniform pale buff. Suture channelled. Whorls seven, of which two constitute the protoconch. Sculpture:—The dominant feature is a prominent peripheral keel revolving round all the whorls; the summit of each whorl is crowned by a double thread; along the fasciole area run four slender threads; between the keel and the anterior end of the shell occur about twenty cords, diminishing progressively as they recede from the periphery; numerous crescentic threads cross the excavate fasciole; fine radial lines also appear in the interstices of the basal spirals. Aperture:—Sinns wide and deep, canal short and open, a thin film of callus on the upper lip. Length 8 mm., breadth 3.5 mm.

Compared with *A. dilecta* this is a shorter, broader shell, and is especially distinguished by the prominent single keel on the periphery.

*Hab.* N. S. Wales:—50 fathoms, Cape Three Points (type); 50 fathoms, Botany Heads ("Thetis"); 59 fathoms, Wata Mooli ("Thetis"); 24 fathoms, Cabbage Tree Island (Museum Expedition); 111 fathoms, Cape Byron (Halligan); 80 fathoms, Gabo Island ("Endeavour"); 80 fathoms, Narrabeen (self).

*FILODRILLIA TROPHONOIDES* *Verco.*

*Drillia trophonoides* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 303, pl. xxvi., figs. 3, 4.

*Hab.* South Australia:—150 fathoms, Beachport (type); 55 fathoms, Cape Borda; 130 fathoms, Cape Jaffa (Verco).

*FILODRILLIA TRICARINATA* Tenison Woods.

(Figure 4.)

*Drillia tricarinata* Tenison Woods, Proc. Linn. Soc. N.S.W., ii., 1878, p. 265. *Id.* Hedley, Rec. Austr. Mus., iv., 1901, p. 23, fig. 3. *Id.* Hedley, Mem. Austr. Mus., iv., 1903, p. 389, fig. 104. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 305. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxiii., 1910, p. 89. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308.



Fig. 4

*Hab.* N.S.Wales:—45 fathoms, Sydney Heads (type); 24 fathoms, Port Stephens; 50 fathoms, Cape Three Points; 50 fathoms, Botany Heads; 75 fathoms, Port Kembla ("Thetis"). Victoria:—Wilson's Promontory ("Endeavour"). Tasmania:—80 fathoms, Schouten Island (May). South Australia:—300 fathoms, Cape Jaffa; 150 fathoms, Beachport (Verco).

*COLUMBARIUM* von Martens.

*Columbarium* von Martens, Conchol. Mittheil., ii., 1881, p. 105; type *Pleurotoma spinicincta* von Martens.

The author of the genus has given the following epitome of its characters<sup>19</sup>: "Notch of the outer lip very faint, canal very distinct, as long as or longer than the rest of the shell, whorls spinously keeled, nucleus globular. . . . The radula exhibits two blunt dagger-shaped teeth, not unlike those of *Defrancia*."

Not appreciating the significance of the radula, Cossmann has argued<sup>20</sup> for the transference of the group to *Fusus*.

From the Australian Tertiary, Professor R. Tate has described the following:—*C. acanthostephes*, *cochleatum*, *craspedotum*, *dictyotis*, *foliaceum*, *setulosum*, and *spiniferum*.

*COLUMBARIUM* DISTEPHANOTIS Melvill.

*Columbarium distephanotis* Melvill, Journ. of Conch., vi., 1891, p. 405, pl. ii., fig. 4.

*Hab.* Queensland:—17 fathoms, Torres Strait (type, Manchester Museum).

*COLUMBARIUM* PAGODOIDES Watson.

*Fusus pagodoides* Watson, Journ. Linn. Soc. Zool., xvi., 1881, p. 383. *Id.* Watson, Challenger Rep. Zool., xv., 1886, p. 197, pl. xiv., fig. 3.

*Columbarium pagodoides* Hedley, Rec. Aust. Mus., vi., 1906, pp. 213, 285.

*Hab.* N.S.Wales:—410 fathoms, off Sydney (type, "Challenger"); 250 fathoms, off Sydney; 80 fathoms, Narrabeen; 100 fathoms, Wollongong (self).

<sup>19</sup> von Martens—Zool. Record, 1881, p. 44, Moll.

<sup>20</sup> Cossmann—Essais Pal. Comp., ii., 1896, p. 64.

## COLUMBARIUM SPINICINCTUM von Martens.

*Pleuratoma (Columbarium) spinicinctum* von Martens, Conchol. Mittheil., ii., 1881, p. 105, pl. xxxi., figs. 1-3. *Id. op. cit.* Schaeko, p. 123, pl. xxiv., figs. 1-2. *Id.* von Martens, Forsch. Gazelle, iii., 1889, p. 266.

*Columbarium spinicinctum* Kobelt, Conch. Cab., 1886, p. 172, pl. xxxiv., figs. 1-2.

*Columbarium pagoda* var. *spinicincta* Tryon, Man. Conch., vi., 1886, p. 176, pl. vii., fig. 99.

*Hab.* Queensland:—76 fathoms, 25 miles east of Noosa Heads (type, "Gazelle").

## LEUCOSYRIX Dall.

*Leucosyrinx* Dall, Bull. Mus. Comp. Zool., xviii., 1889, p. 75. *Id.* Sater, Man. N.Z. Moll., 1913, p. 470.

*Leucosyrinx recta* Hedley, formerly referred here, is now placed in *Filodrillia*.

## LEUCOSYRIX CASEARIA Hedley and Petterd.

*Leucosyrinx casearia* Hedley and Petterd, Rec. Austr. Mus., vi., 1906, p. 220, pl. xxxvii., fig. 5.

*Hab.* N.S. Wales:—250 fathoms, off Sydney (type, self).

## TURRIDRUPA gen. nov.

Shell solid, cylindro-fusiform. Colour usually monochrome, sometimes brown orange or yellow. Protoconch of two smooth turbinate whorls, followed by a whorl ornamented with close arcuate riblets. Adult sculpture consisting of numerous revolving keels, one or more of which may break up into bead rows. Fasciole indefinite. Notch a short sub-circular incision with a raised margin. Throat with revolving ridges on the palate. Type *Pleuratoma acutigemmata* Smith.

Besides the species which here follow, the inclusion in *Turridrupa* is suggested of—*Pleuratoma cerithina* Anton (= *digitalis* Reeve), *cincta* Lamarek, *jubata* Hinds, *congyroni* Souverbie, and *Drillia siboga* Schepman.

## TURRIDRUPA ACUTIGEMMATA Smith.

(Plate xlii., figs. 12, 13.)

*Pleuratoma acutigemmata* Smith, Ann. Mag. Nat. Hist., (4), xix., 1877, p. 489, and (7), xiii., 1904, p. 457. *Id.* Melvill and Staunden, Proc. Zool. Soc. 1901, ii., p. 433. *Id.* Melvill and Sykes, Proc. Malac. Soc., ii., 1897, p. 145. *Id.* Schepman, Siboga Exped., xlix., 1913, p. 400.

*Turris acutigemmata* Melvill, Proc. Malac. Soc., xii., 1917, p. 146, pl. viii., fig. 1.

*Pleuratoma jubata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 152 (not *P. jubata* Hinds).

*Pleuratoma armillata* Brazier, *op. cit.*, p. 151 (not *P. armillata* Reeve).

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier); 5 to 10 fathoms, Hope Island (self).

TURRIDRUPA BIJUBATA *Reeve*.

*Pleurotoma bijubata* Reeve, Conch. Icon., i., 1843, pl. x, fig. 87. *Id.* Reeve, Proc. Zool. Soc., 1843, p. 182. *Id.* Smith, Journ. Linn. Soc. Zool., xii., 1876, p. 537. *Id.* Brazier, Journ. of Conch., ii., 1879, p. 186. *Id.* Smith, Fauna Laccadive, ii., 1903, p. 603. *Id.* Couturier, Journ. de Conch., lv., 1907, p. 129.

*Drillia bijubata* Schmeltz, Cat. Mus. Godeffroy, iv., 1869, p. 90. *Id.* Tapparone Canefri, Bull. Soc. Zool. France, 1878, p. 247.

*Sarcula bijubata* Bouge and Dantzenberg, Journ. de Conch., lxi., 1914, p. 144.

*Hab.* Queensland:—Fitzroy Island (Brazier); Murray Island, Hope Island, and Palm Island (self).

TURRIDRUPA COMMENTICA *Hedley*.

*Drillia commentica* Hedley, Proc. Linn. Soc. N.S.W., xxxvi., 1915, p. 727, pl. lxxxii., fig. 59.

*Hab.* Queensland:—10 fathoms, Cape Sidmouth (type, Henu); 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Island (self).

TURRIDRUPA DECEPTRIX *sp. nov.*

(Plate xlii., fig. 14.)

Shell elongate-conic, very solid, contracted at the base, constricted and channelled at the suture, last whorl about half the total length; eleven whorls, including the protoconch. Colour pale ochraceous-buff, aperture lighter. Sculpture:—Last whorl with thirteen, penultimate with four, and earlier whorls with three prominent spiral keels, the furrows between which carry faint radial striæ, and sometimes a small interstitial thread. Aperture:—There is a thin callus sheet on the inner lip, and a solid callus plug at the angle of the aperture; outer lip simple; sinus a semicircular notch with reflected margin; canal short, open, and slightly recurved; deep within the throat are five revolving raised threads. Length 14 mm., breadth 5 mm.

This is deceptively like *Turris brevicandata*, but differs in the essential character of the peripheral carina, being single instead of double; it is besides smaller, more slender, with a shorter canal, and the whorls divided by a deeper suture. I have received a specimen of *T. deceptrix* labelled "*Pleu. bijubata* Reeve, Philippines."

*Hab.* Queensland:—30 fathoms, Darnley Island (type, Brazier).

TURRIDRUPA FASTOSA *Hedley*.

*Pleurotomella fastosa* Hedley, Rec. Austr. Mus., vi., 1907, p. 295, pl. lv., fig. 21.

*Hab.* N.S. Wales:—80 fathoms, Narrabeen (type, self).

## TURRIDRUPA PERTINAX Hedley.

(Plate xliii., fig. 15.)

Shell small, cylindro-fusiform, contracted at the base. Colour pale buff, darker on the base and the columella. Whorls eight, including the protoconch. Suture deeply channelled. Sculpture:—On the last whorl there is a prominent keel on the shoulder, followed anteriorly by seven evenly spaced and gradually diminishing spirals; above the keel is a broad fasciole, crossed by fine crescentic riblets and bounded by a small spiral; on the upper whorls three spirals alone persist, the median being prominent. Aperture narrow; sinns wide and rather short; canal short and a little reflected; columella straight, with a thickened margin. Length 5 mm., breadth 1.5 mm.

This species may be distinguished from its associate, *T. communica*, by less prominent keels and more cylindrical form.

*Hab.* Queensland:—5 to 10 fathoms, Hope Islands (type); 15 fathoms, Palm Island (self); 20 fathoms, between Cairns Reef and Endeavour Reef (McCulloch); off Cape Sidmouth (Hemm); Darnley Island (Brazier). Papua:—Katow (Brazier).

## EPIDEIRA Hedley.

*Epideira* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, p. M 79. Type *Charatula striata* Gray, 1827.

Shell solid, ovate-acuminate, last whorl about as long as the spire. Sculpture:—A bead-row along the fasciole, and frequently another along the suture, separated by a broad furrow; the base is cancellate with radial and revolving cords. Protoconch smaller and less elevated than that of *Turris* or *Inquisitor*, of two smooth turbinate whorls, set a little obliquely, and from one aspect appearing bulbous. Fasciole ascending the spire in the middle of each whorl. Notch broad and shallow. Outer lip not inflected; canal very short. Pillar a little twisted. Operculum of the turrid type.

In general appearance this genus approaches *Charatula*, to which indeed the type species was originally assigned. The operculum here noted (Plate xliii., fig. 20) in the case of *E. striata*, and previously described by Sir J. Verco for *E. perksi* and *E. quoyi*, however excludes it. In the pattern of the sculpture *Gemmula* has some likeness to *Epideira*, but the post-nepionic sculpture separates it. A near relation is *Bathytoma*, from which *Epideira* is separable by sculpture, shorter canal, taller spire, more numerous whorls, and straighter columella.

*Epideira* seems to be represented in New Zealand by *Pleurotoma rosea* Quoy and Gaimard.

## EPIDEIRA GABENSIS sp. nov.

(Plate xliii., fig. 16.)

Shell rather thin; ovate-lanceolate. Colour buff, variegated with white clouds about the periphery, and chestnut spots on the suture. Whorls seven, including a smooth two-whorled protoconch. Suture

irregular. Beneath the suture runs an unbeaded cingulus, followed by a distinct excavation. This is bounded by the fasciole, composed of a row of beads, compressed or inclined to crescentic, set at twenty-four to the last whorl and twenty to the penultimate. Anterior to the bead row are seven or eight major spirals, one or two of which recur on the upper whorls. Small spiral threads run along the furrow and the bead row, also two or three in each interstice of the major spirals. Fine growth lines occur over the whole shell. Aperture pyriform; lip simple and straight. Sinus at the end of the bead-row wide and shallow. Canal short and open. Length 21 mm., breadth 9 mm.

Nearest to this is *E. xanthophus*, which is far narrower and has a smaller protoconch. *E. xanthophus* has several bead rows, but *jaffensis* only one, in which the beads are closer, smaller, and more compressed.

*Hab.* Victoria:—80 fathoms, Gabo Island (type, "Endeavour").

*EPIDEIRA JAFFENSIS* Vervo.

*Drillia jaffensis* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 298, pl. xxvi., figs. 7, 8, 9.

*Hab.* South Australia:—130 to 300 fathoms, Jaffa (type); 104 fathoms, Neptune Islands; 110 fathoms, Beachport (Vervo).

*EPIDEIRA PERKSI* Vervo.

*Succula perksi* Vervo, Trans. Roy. Soc. S.A., xx., 1896, p. 224, pl. viii., fig. 3.

*Hemipleurotoma perksi* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 295.

*Hab.* South Australia:—15 fathoms, Thistle Island (type, Vervo).

*EPIDEIRA PHILIPINERI* Tenison Woods.

(Plate xliii., fig. 17.)

*Pleurotoma quoyi* Reeve, Couch. Icon., i., 1843, pl. xvi., fig. 137.

*Succula quoyi* Tryon, Man. Conch., vi., 1884, p. 242, pl. vii., fig. 95.

*Hemipleurotoma quoyi* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 368. *Id.* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 294, and xxxvi., 1912, p. 231 (not *Pleurotoma quoyi* Des Moulins).

*Pleurotoma monile* Rousseau, Zool. Voy. Pole Sud., v., 1854, p. 110, pl. xxv., figs. 17-18 (not *Pleurotoma monile* Kiener).

*Pleurotoma philipineri* Tenison Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 136. *Id.* May, *op. cit.*, 1902 (1903), p. 110. *Id.* Hardy, *op. cit.*, 1915, p. 68.

*Hab.* Tasmania:—N. W. Coast (type, Petterd). South Australia:—10 to 22 fathoms, Spencer and St. Vincent Gulfs; 130 fathoms, Cape Jaffa; 200 fathoms, Beachport (Vervo). Western Australia:—100 fathoms, ninety miles west of Eucla (Vervo). The locality of Amboina given by Rousseau is of course wrong.

EPIDEIRA QUOYI *Des Moulins*.

"Une espèce avec des taches quadrilatères pres des sutures," Quoy and Gaimard, Zool. Astrolabe, ii., 1833, p. 525.

*Pleurotoma monile* Kiener, Coq. Viv., 1840, p. 52, pl. xv., fig. 3.

*Clavatula monile* Tryon, Man. Conch., vi., 1884, p. 232, pl. vii., fig. 96 (not *Pleurotoma monile* Brocchi, Conch. foss. subapenn., ii., 1814, p. 432).

*Pleurotoma quoyi* nom. mut. Des Moulins, Act. Soc. Linn. Bordeaux, xii., 1842, p. 167. *Id.* Weinkauff, Conch. Cab., 1876, p. 101, pl. xxii., fig. 2. *Id.* Watson, Chall. Rep. Zool., xv., 1886, p. 304.

*Drillia quoyi* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 170.

This smooth species has been confused by Reeve and subsequent writers with another form (*E. philipineri*), beaded along the suture and beneath the fasciole.

*Hab.* Victoria:—Western Port (type, Astrolabe); Apollo Bay, Warrnambool (Pritchard). Tasmania:—38 to 40 fathoms, off East Monceur Island ("Challenger").

EPIDEIRA SCHOUTANICA *May*.

*Drillia schoutanica* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 391, pl. xiv., fig. 17. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxvi., 1913, p. 73.

*Hab.* Tasmania:—80 fathoms, Schouten Island (type, May); Bass Strait ("Endeavour"). South Australia:—365 fathoms, Cape Martin (self).

EPIDEIRA STRIATA *Gray*.

(Plate xliii., figs. 18, 19, 20.)

*Clavatula striata* Gray, King's Survey, ii., 1827, Appendix p. 485.

*Pleurotoma orenii* Reeve, Conch. Icon., i., 1843, pl. ix., fig. 70. *Id.* Weinkauff, Conch. Cab. 1876, p. 98, pl. xxi., fig. 5. *Id.* Watson, Chall. Zool. Rep., xv., 1886, p. 312.

*Drillia oreni* Angas, Proc. Zool. Soc., 1876, p. 202.

*Surcula oreni* Brazier, Journ. of Conch., vi., 1889, p. 70.

*Hab.* N.S. Wales:—2 to 10 fathoms, Port Jackson ("Challenger"); Ballina (self).

EPIDEIRA TORQUATA *sp. nov.*

(Plate xliii., fig. 21.)

*Pleurotoma philipineri* Tryon, Man. Conch., vi., 1884, p. 167, pl. xxxiv., fig. 82. *Id.* Kobelt, Conch. Cab., 1887, p. 227, pl. xli., fig. 17 (not *Pleurotoma philipineri* Tenison Woods).

Shell small; ovate-lanceolate; turreted. Colour ochraceous-yellow, irregularly spotted with white. On the subsutural ridge are large square spots, spaced at six to a whorl, and alternating with dark chestnut spots. Whorls seven and a half. Suture impressed. Protoconch of a whorl and



a half, smooth, and slightly bulbous. Fasciole impressed, distinct, bounded on each side by a stout ridge, having prominent tubercles arranged about twelve to a whorl. Anterior to these on the last whorl are seven prominent spiral cords, the interstices of which carry one or two minute threads. All these are crossed by fine growth lines. Sinus rather wide and shallow. Lip simple and thin. Pillar slightly twisted. Length 20 mm., breadth 8 mm.

This is distinguished from *E. quoyi* by beaded lyræ, and from *E. philipineri* by smaller size, more slender shape, fewer beads to a whorl, and fewer, wider-spaced spirals. Apparently Beddome substituted this for *E. philipineri* when he sent a parcel of Tasmanian shells to Tryon for illustration in the Manual. Instead of the usual interpretation of a single species, Tryon recognised three species, as I do, in this group: but under the name of *mobile* he figured *quoyi*, *philipineri* he called *quoyi*, and *torquata* he figured as *philipineri*.

*Hab.* Tasmania:—Port Arthur (type, Mawle).

#### EPIDEIRA XANTHOPHÆS Watson.

*Pleurotoma xanthophæus* Watson, Chall. Zool. Rep., xv., 1886, p. 282, pl. xxvi., fig. 1.

*Hemipleurotoma tasmanica* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 391, pl. xiii., fig. 16.

*Hab.* N. S. Wales:—30 to 35 fathoms, off Sydney Heads (type of *xanthophæus*, Challenger). Tasmania:—40 fathoms, Schouten Island (type of *tasmanica*, May).

#### BATHYTOMA Harris and Burrows.

*Bathytoma* Harris and Burrows, Eocene and Oligocene Paris, 1891, p. 113, new name for *Dolichotoma* Bellardi, Mon. terz. Piem., 1875, p. 229, type *Pleurotoma cataphracta* Brocchi (not *Dolichotoma* Hope, 1839). *Id.* Tate, Proc. Roy. Soc. N.S.W., xxxi., 1898, p. 398.

*Megasurcula* Casey, Trans. St. Louis Acad., xiv., 1904, p. 147.

(?) *Cryptococcus* Koenen, Palæontographica, xvi., 1867, p. 167, type *Pleurotoma pilosa* Lamarck. *Id.* Dall, Proc. Nat. U.S. Museum, liv., 1918, p. 325.

From the Australian Tertiary beds, Messrs. Denuant and Kitson catalogue<sup>21</sup>: *Bathytoma paracantha* T. Woods, *fontinalis* Tate, *decomposita* Tate, *angustifrons* Tate, and *pritchardi* Tate.

#### BATHYTOMA AGNATA Hedley and Petterd.

*Bathytoma agnata* Hedley and Petterd, Rec. Austr. Mus., vi., 1906, p. 220, pl. xxxvii., fig. 3.

*Hab.* N.S.Wales:—250 fathoms, off Sydney (type, self).

<sup>21</sup> Denuant and Kitson—Rec. Geol. Survey Victoria, i., 1903, p. 96.

## BATHYTOMA HECTORGUIA Verco.

*Drillia hectorguia* Verco, Trans. Roy. Soc. S.A., xxxi., 1907, p. 215, text figs. 2, 3.

*Hab.* South Australia:—104 fathoms, off Neptune Islands (Verco).

## BORSONIA Bellardi.

*Borsonia* Bellardi, Bull. Soc. Geol. de France, x., 1838, p. 30, type *Borsonia prima* Bellardi.

From the Australian Tertiary, Professor R. Tate described the following:—*Borsonia halleutu*, *atrayensis*, *polyesta*, and *protensa*.

## BORSONIA CEROPLASTA Watson.

*Borsonia ceroplasta* Watson, Chall. Rep. Zool., xv., 1886, p. 368, pl. xviii., fig. 2. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 328.

*Hab.* South Australia:—300 fathoms, Cape Jaffa (Verco).

## AWATERIA Suter.

*Awateria* Suter, N.Z. Geol. Surv., Pal. Bull. No. 5, Pt. I., 1917, p. 57, type *Awateria streptophora* Suter.

In general shape and sculpture the type of this genus is reminiscent of *Arcularia*, the protoconch is comparatively large; the fasciole runs between the wreath of subsutural nodules and the upright ribs; the canal is short, wide, and effuse. From *Epideira*, to which it seems to be related, the larger protoconch, few and rapidly increasing whorls, subcylindrical form and shallow sinus of *Awateria* readily distinguish it. Hitherto the genus has only been known from the Pliocene of New Zealand. Now it is proposed to utilise *Awateria* for the reception of *Pleurotoma challengerii* Smith, a recent deep water species from off Sydney.

## AWATERIA CHALLENGERI Smith.

*Pleurotoma (Drillia) challengerii* Smith, Proc. Zool. Soc., 1891, p. 438, pl. xxxiv., fig. 7. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxvi., 1903, p. 22.

*Hab.* N.S.Wales:—410 fathoms, off Sydney (type, "Challenger"); 300 fathoms, off Sydney (self).

## AWATERIA CROSSEI Smith.

*Pleurotoma (Drillia) crossei* Smith, Proc. Zool. Soc., 1891, p. 439, pl. xxxiv., fig. 8.

*Hab.* N.S.Wales:—410 fathoms, off Sydney (type, "Challenger").

This classification of *crossei*, *hoylei*, and *watsoni* is merely tentative. Specimens of these species are not available for study, and their illustrations are not satisfactory.

*AWATERIA HOYLEI* Smith.

*Pleurotoma (Drillia) hoylei* Smith, Proc. Zool. Soc., 1891, p. 439, pl. xxxiv., fig. 9.

*Hab.* N.S.Wales:—410 fathoms, off Sydney (type, "Challenger").

*AWATERIA WATSONI* Smith.

*Pleurotoma (Drillia) watsoni* Smith, Proc. Zool. Soc., 1891, p. 439, pl. xxxiv., fig. 10.

*Hab.* N.S.Wales:—410 fathoms, off Sydney (type, "Challenger").

*MITRITHARA* *gen. nov.*

Shell small, solid, biconical to cylindro-fusiform. Whorls four. Protoconch blunt. Colour white or buff, uniform or spotted with brown. Sculpture—close revolving cords, sometimes decussated with radial riblets. No varix, lip thin, sinus evanescent, columella incrassate, with an indistinct single or double plication. Canal wide and short, throat lyrate within. Type, *Columbella alba* Petterd.

A characteristic member of this genus is the tertiary fossil *Mitra daphnelloides* Tenison-Woods,<sup>22</sup> from Muddy Creek, Victoria. This was afterwards transferred by Tate and Cossmann to *Mitromorpha*.<sup>23</sup> The figure of the tertiary fossil *Cordieria conospira* Tate,<sup>24</sup> suggests that it may belong here also. The recent African species *Mitromorpha volva* Sowerby,<sup>25</sup> is probably co-generic.

Probably *Mitrithara* is related to *Autimitra*.<sup>26</sup> I have not the means to institute a comparison, but understand from Mr. Iredale that he considers them distinct.

*MITRITHARA ALBA* Petterd.

(Plate xliii., fig. 22.)

*Columbella alba* Petterd, Journ. of Conch., ii., 1879, p. 104. *Id.* Kobelt, Conch. Cab., iii., 1897, p. 288. *Id.* Tate, Journ. Roy. Soc. N.S.W., xxxi., 1897, p. 397.

*Mitromorpha alba* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1904, pp. 372, 455. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 328.

*Mitromorpha glindersi* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 104, pl. viii., fig. 6, and xviii., 1906, p. 51.

<sup>22</sup> Tenison-Woods—Proc. Linn. Soc. N.S.W., iv., 1880, p. 7, pl. ii., fig. 3.

<sup>23</sup> Tate—Journ. Roy. Soc. N.S.W., xxxi., 1897, p. 397; Cossmann—Essai Pal. Comp., vii., 1906, p. 224.

<sup>24</sup> Tate—Journ. Roy. Soc. N.S.W., xxxi., 1898, p. 396.

<sup>25</sup> Sowerby—Marine Shells of South Africa, 1892, p. 7, pl. i., fig. 16.

<sup>26</sup> Iredale—Proc. Mal. Soc., xii., 1917, p. 329.

Messrs. Pritchard and Gatliff, having overlooked Petterd's name when they re-described his species, afterwards proposed to reject it on the ground of preoccupation by Jeffreys. But the *nomen nudum* used by Jeffreys<sup>27</sup> was *Fusus albus*, upon which Petterd's *Columbella alba* does not infringe.

*Hab.* Tasmania:—Blackmans Bay (type, Petterd); King Island (May). Victoria:—Flinders (Gatliff). South Australia:—60 fathoms, St. Vincent Gulf; 90 fathoms, Cape Borda; 200 fathoms, Beachport; St. Francis Island (Verco).

MITRITHARA ANGUSTA Verco.

*Mitromorpha angusta* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 329, pl. xxvii., figs. 4, 5.

*Hab.* South Australia:—110 fathoms, Beachport (type); 55 fathoms, Cape Borda (Verco).

MITRITHARA AXICOSTATA Verco.

*Mitromorpha axicostata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 330, pl. xxviii., fig. 4.

*Hab.* South Australia:—104 fathoms, Neptune Island (type); 110 fathoms, Beachport; 130 fathoms, Cape Jaffa (Verco).

MITRITHARA AXISCALPTA Verco.

*Mitrithara alba* var. *axiscalpta* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 329.

*Hab.* South Australia:—St. Vincent Gulf: 55 fathoms, Cape Borda; 110 fathoms, Beachport (Verco).

MITRITHARA COLUMNARIA sp. nov.

(Plate xliii., fig. 23.)

Shell rather large and thin, regularly fusiform. Colour pale yellow-orange, with a zone of alternate brown and buff beneath the suture. Whorls eight, of which three are included in the protoconch. Suture impressed. Sculpture:—Radials entirely absent; spirals amount to thirty-two on the last whorl and to ten on the penultimate; the summit of the whorl is crowned by a strong cord followed by a corresponding sulcus, thence the spirals diminish to the periphery, where they are small and crowded, with another change the base and snout are occupied by eight broad and widely spaced spirals. Lip incomplete in the specimen examined; the columella has two low folds. Length 13 mm., breadth 5 mm.

This species stands near to *M. alba*, than which *M. columnaria* is of more slender proportions, thinner, longer, and with more numerous, finer spirals.

*Hab.* Tasmania:—100 fathoms, Cape Pillar (type, W. L. May and self).

<sup>27</sup> Jeffreys—Ann. Mag. Nat. Hist., viii., 1841, p. 165.

MITRITHARA COSTIFERA *May*.

*Mitromorpha costifera* May, Proc. Roy. Soc. Tasm., 1919, p. 56, pl. xiv., fig. 2.

*Hab.* Tasmania :—40 fathoms, Thonin Bay (type, May).

MITRITHARA INCERTA *Pritchard and Gatliff*.

*Mangelia incerta* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xiv., 1902, p. 181, pl. ix., fig. 1, and xviii., 1906, p. 50.

*Mitromorpha incerta* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 330.

*Hab.* Victoria :—Western Port (type, Gatliff). South Australia :—St. Vincent Gulf to St. Francis Island (Verco).

MITRITHARA MULTICOSTATA *May*.

*Mitromorpha multicostata* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 394, pl. xv., fig. 22.

*Hab.* Tasmania :—100 fathoms, Cape Pillar (type, May).

MITRITHARA PAUCILIRATA *Verco*.

*Mitromorpha paucilirata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 332, pl. xxvii., figs. 8, 9.

*Hab.* South Australia :—90 fathoms, Cape Jaffa (type); 62 fathoms, Cape Borda; 104 fathoms, Neptune Island; 110 fathoms, Beachport (Verco).

Var. CRASSILIRATA *Verco*.

Verco *op. cit.*, p. 333.

*Hab.* South Australia :—56 fathoms, Cape Borda (type, Verco).

MITRITHARA PAULA *Verco*.

*Mitromorpha paula* Verco, Trans. Roy. Soc. S.A., xxxiii., p. 331, pl. xxviii., fig. 5.

*Hab.* South Australia :—St. Vincent Gulf; 22 fathoms, Backstairs Passage (Verco).

Var. LEUCA *Verco*.

Verco *op. cit.*

*Hab.* South Australia :—45 fathoms, Neptune Islands; 130 fathoms, Cape Jaffa; 110 fathoms, Beachport; 62 fathoms, Cape Borda (Verco).

*MITRITHARA PROLES* sp. nov.

(Plate xliii., fig. 24.)

Shell small, rather thin, ovate-fusiform. Colour buff, clouded with pale brown on the periphery. Whorls six, including two of the protoconch. Sculpture:—The whole shell is over-run with spiral flat-topped cords, which become gradually smaller and closer on approaching the anterior end; twenty-five of these occur on the last whorl, of which eight ascend the penultimate; the radials are curved delicate riblets, tapering upwards, and vanishing before reaching the summit of the whorl; these riblets disappear on the last whorl; the penultimate carries about twenty-five. Aperture wide; sinus a slight sigmoid flexure, the outer lip thin, curved forward; deep within are fifteen short spiral lyræ; two small plications on the columella; canal short and broad. Length 6 mm., breadth 2.7 mm.

This form was at first<sup>28</sup> mistaken for *M. alba*. It is, however, much nearer to the fossil *M. daphnelloides*, of which it may be a variety, differing by a more pointed protoconch, less prominent plications on the columella, and finer, closer riblets.

*Hab.* N.S.Wales:—80 fathoms, 22 miles east of Narrabeen (type): 100 fathoms, Port Macquarie (self): 50 fathoms, Cape Three Points ("Thetis"). Victoria:—80 fathoms, Gabo Island ("Endeavour").

INQUISITOR *Hedley*.

*Inquisitor* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, p. M. 79. Type, *Pleurotoma sterrha* Watson; *Drillia auctorum* in part (not *Drillia* Gray, Ann. Nat. Hist., i., 1838, p. 28).

The group here discussed has hitherto been called "Drillia," but examination shows that name to be inapplicable. By original usage, the type being *umbilicata*, *Drillia* was applied to an African group already named *Clavatula* by Lamarek.<sup>29</sup> Having later realised that this African group was already provided with a name,<sup>30</sup> Gray deflected "Drillia" for service in another direction. In this resurrected existence *Drillia* has been improperly employed for an Indo-Pacific group.

Compared with *Clavatula* the shell of *Inquisitor* is less massive, but more long and slender, with a spire taller in proportion. Radial sculpture is usually dominant in *Inquisitor*, where the grooved fasciole runs rather closer to the suture, and where the aperture in aged specimens is sometimes a little contracted by inflection of the outer lip. There is rarely a false umbilicus. The operculum of *Inquisitor* is lanceolate with the nucleus apical, instead of medio-lateral, as in *Clavatula*.

<sup>28</sup> Hedley—Rec. Austr. Mus., vi., 1907, p. 298.

<sup>29</sup> Maltzan—Jahrb. deut. malak. Gesell., x., 1883, p. 121, pl. iii., fig. 5. Dall—Proc. U.S. Nat. Mus., liv., 1918, p. 324.

<sup>30</sup> Gray—Ann. Mag. N. Hist. (2), vii., 1851, p. 337, and Syst. Arrang. Moll. Brit. Mus., 1856, p. 8.

The shell reported by Brazier<sup>31</sup> as *Drillia alabaster* var. is here described as *I. plindershami*.

*Drillia cearata* Reeve was identified by Sowerby<sup>32</sup> from South Australia. It has been indicated<sup>33</sup> that this species is American, not Australian.

*Drillia crenularis* Lamk. was identified by Pritchard and Gatliff from Portland, Victoria.<sup>34</sup> Confirmation of this doubtful record would be acceptable.

*Drillia patillus* Reeve, recorded by Brazier<sup>35</sup> from Cape York, is here described as *I. granobalteatus* Hedley.

*Drillia pseudocarinata* Reeve was recorded by Tenison-Woods<sup>36</sup> from King Island. It has not since been recognised.

*Drillia sinensis* Hinds was reported by Brazier<sup>37</sup> from Cape Grenville, Queensland. His specimens prove to be *I. stercha* Watson.

*Drillia revillam* Reeve was reported by Angas<sup>38</sup> from Middle Harbour, N.S.Wales. This is an American, not an Australian species.

*Drillia weldiana* Tenison-Woods, described as from Tasmania, has been noted as a synonym of the foreign *D. fucata* Reeve.<sup>39</sup>

#### INQUISITOR CORIORUDIS *sp. nov.*

(Plate xliii., fig. 25.)

Shell lanceolate, subturreted, spire slender and tall. Whorls ten, of which two constitute the protoconch. Suture deeply impressed. Colour olive-buff, with irregular fawny dashes. Epidermis thin and fibrous. Sculpture:—The earlier whorls have a double row of prominent peripheral beads, arranged about ten to a whorl; by interposition of additional spirals each double bead extends into a short oblique nodose rib; below the suture is an indefinite band, followed by a distinct and excavate fasciole; the latter is sculptured with fine lunate striæ; on the last whorl anterior to the fasciole are about twenty-three prominent but irregular spiral cords, some of which are rendered nodulous by passing over the ribs. Aperture:—Outer lip sharp and simple; sinus wide and V-shaped; columella coated with a thin callus. Length 23 mm., breadth 7 mm.

This species has a general resemblance to *I. coei*, but is a more slender form, having both radial and spiral sculpture more prominent.

*Hab.* N.S.Wales:—300 fathoms, 27 miles east of Sydney (type, self).

<sup>31</sup> Brazier—Proc. Linn. Soc. N.S.W., i., 1876, p. 154.

<sup>32</sup> Sowerby—Proc. Mal. Soc., ii., 1896, p. 24.

<sup>33</sup> Hedley—Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 312.

<sup>34</sup> Pritchard and Gatliff—Proc. Roy. Soc. Vict., xii., 1900, p. 172.

<sup>35</sup> Brazier—Proc. Linn. Soc. N.S.W., i., 1876, p. 152.

<sup>36</sup> Tenison-Woods—Proc. Roy. Soc. Tasm., 1877, p. 27.

<sup>37</sup> Brazier—Proc. Linn. Soc. N.S.W., i., 1876, p. 152.

<sup>38</sup> Angas—Proc. Zool. Soc., 1867, p. 203.

<sup>39</sup> Hedley—Proc. Roy. Soc. Tasm., 1902 (1903), p. 77.

INQUISITOR COXI *Angas*.

(Plate xliii., fig. 26.)

*Drillia coxi* Angas, Proc. Zool. Soc., 1867, p. 113, pl. xiii., fig. 15. *Id.* Tenison-Woods, Proc. Roy. Soc., Tasm., 1877, p. 27. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 368. *Id.* Hedley, Mem. Austr. Mus., iv., 1903, p. 388. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 301.

*Drillia agnewi* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 36. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 368, pl. xxiv., fig. 29. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 62.

*Drillia trailli* Pritchard and Gatliff (not Hutton), Proc. Roy. Soc. Vict., xviii., 1906, p. 49.

The colour is buff, sometimes dashed with chestnut. The example figured is from Sydney Harbour, and is 33 mm. long.

*Hab.* N.S.Wales:—Port Jackson, type of *coxi* (Angas); Jervis Bay (Brazier); 22 fathoms, Manning River entrance; 63 to 75 fathoms, Port Kembla ("Thetis"). Victoria:—Portland (Mrs. A. F. Kenyon). Tasmania:—Table Cape (Atkinson).

INQUISITOR CRASSICINGULATUS *Schepman*.

*Mungilia crassicingulata* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 434, pl. xxix., fig. 1. *Id.* Odbner, Kungl. Sv. Vet. Akad. Handl. Bd., lii., 1917, p. 52.

*Hab.* Western Australia:—11 fathoms, 45 miles W.S.W. of Cape Jaubert (Mjöberg).

INQUISITOR FIBRATUS *sp. nov.*

(Plate xliii., fig. 27.)

Shell solid lanceolate. Colour uniform dull white. Whorls ten. Sculpture:—Except where interrupted by the spirals, the shell is over-run by very close microscopic radial lamellæ, a series of which rise along the suture and curl into arched scales; these crowning the summit of each whorl give a distinct recognition mark to the species; this crest of scales is underlined by a stout undulating cord; though excavate out of the general contour the fasciole is not well differentiated, it is sculptured by radial lamellæ and traversed by two or three spiral threads; on the last whorl, anterior to the fasciole, run about sixteen rather flat-topped spiral lyræ, about twice their own breadth apart, between which one or two minute interstitial threads may occur; on the penultimate are four such spirals; wave-like ribs are set at about thirteen to a whorl, interrupted by the fasciole, but continuing to the base and ascending the spire perpendicularly. Aperture:—The month is narrow; canal short and wide; sinus deeply U-shaped; margin everted. Behind the aperture is a varical swelling, followed by a narrow pocket groove, beyond which again



the outer lip is turned inwards, giving rise to a short free edge. The callus on the columella is a thick sheet, the anterior edge of which is free from the preceding whorl. Length 16 mm., breadth 5.5 mm.

This species is closely allied to and perhaps a variety of *I. spaldingi* Brazier. The differences are that *gibratus* is longer and narrower, with more ribs and more prominent spirals, and especially with a secondary sculpture of minute hair lines which develop into a subsutural row of close minute prickles.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self); Cape York; Darnley Island (Brazier); Facing Island; Port Curtis (Kesteven).

INQUISITOR FLINDERSIANUS *sp. nov.*

(Plate xliv., fig. 28.)

*Pleurotoma alabaster* var. Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 154 (not *P. alabaster* Reeve).

Shell rather large and solid, slender fusiform. Whorls eleven. Colour ochraceous-salmon, with a pale zone on the shoulder. Sculpture:—Fasciole slightly excavate, crossed by crescentic lines, and traversed by fine threads; ribs discontinuous, oblique, widely spaced, round-backed, bolder on the upper whorls, disappearing on the ventral side of the last whorl, but re-appearing on the dorsal; set at twelve to a whorl; spirals are flat-topped cords which over-ride the ribs—about twenty-two on the last whorl and five or seven on the upper whorls; their furrows are crossed by microscopic hair lines, and often traversed by an interstitial thread. Aperture:—Mouth narrow; varix broad and low, about its own breadth within the edge of the free flap which stretches across the mouth; sinus deep, oblique, narrowed at the entrance; columella straight; inner lip with a raised margin; canal short, open. Length 31 mm., breadth 11 mm.

*Hab.* Queensland:—10 fathoms, Mapoon (type); 4 to 14 fathoms, Albany Passage; 5 to 8 fathoms, Murray Island (self); 30 fathoms, Darnley Island (Brazier).

INQUISITOR FORMIDABILIS *sp. nov.*

(Plate xliv., fig. 29.)

Shell large but comparatively thin, fusiform, subturreted, sharply pointed; spire produced; base contracted. Whorls thirteen. Colour grey-buff, maculated with chestnut at the sutures. Sculpture:—The radials are oblique, wide-spaced, low peripheral nodular riblets, ten on the penultimate, and eleven on the last whorl; on the earlier whorls the ribs ascend the spire perpendicularly and continuously, but on the lower whorls they are less developed and less regular; there is a secondary sculpture of fine radial threads which sometimes crowd the interstitial spaces of the spirals; on the last whorl are about thirty-two broad spiral cords, and on the penultimate ten; in their interstices one or more spiral

threads may arise; a funicular rib on the anterior end of the shell encloses a small false umbilicus; the fasciole is broad, and is appressed to the suture; it is smooth save for crescentic growth lines. Aperture:—The sinus is wide and V-shaped; the outer lip is arched forwards, and the free sharp edge is bent inwards a little towards the aperture; opposite the base of the canal is a stromboid inflection; canal short, wide, and sharply recurved; columella overspread with a thick callus rising in a low tubercle opposite the sinus. Length 46 mm., breadth 15 mm.

This is a member of the group of *Drillia flavidula*. In size and contour it resembles the Japanese *Drillia jeffreysi* Smith,<sup>40</sup> but the Queensland shell is narrower, the nodular ribs not so prominent, and the spirals are finer and closer.

*Hab.* Queensland:—10 fathoms, off Mapoon (type, self); Keppel Bay (Brazier).

INQUISITOR GLAUCE Dall.

(Figure 5.)

*Pleurotoma (Drillia) ventricosa* Smith, Ann. Mag. Nat. Hist., (6), ii., 1888, p. 301.

*Drillia ventricosa* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1908, p. 487, pl. x. fig. 3 (not *Pleurotoma ventricosa* Deshayes, 1833).

*Pleurotoma glauce* Dall, Proc. U.S. Nat. Mus., liv., 1918, p. 333.

*Hab.* Queensland:—Between Percy Island and the mainland (Macgillivray).

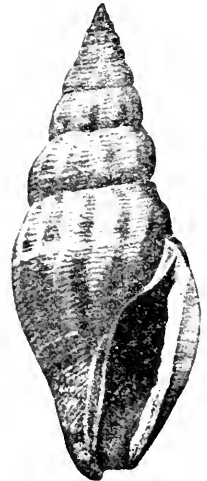


Fig. 5.

INQUISITOR GRANOBALTEUS *sp. nov.*

(Plate xlv., fig. 30.)

*Drillia putilla* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 152 (not *Pleurotoma putillus* Reeve).

Shell rather thin, elongate-fusiform, turreted. Whorls ten. Sutures channeled. Colour pale buff, with rust dots between the peripheral nodules, and irregular rust streaks and splashes elsewhere. Sculpture:—On the summit of each whorl is a collar of two strong spirals; besides, the whole surface is over-run with fine, close, flat-topped spiral threads, amounting to about fifty-five on the last whorl; along the shoulder runs a row of upright tubercles, twice as high as broad, and more than their own breadth apart—twenty-two on the penultimate whorl, most distinct on the earlier whorls, and gradually fading till they almost disappear on

<sup>40</sup> Smith. Ann. Mag. Nat. Hist., (4), xv., 1875, p. 417.

the last whorl; from these evanescent tubercles faint radials descend to the base; the trough of the deeply excavate fasciole is crossed by fine crescentic radial threads. Aperture:—Lip thin, its edge not reflected, without internal lyræ; sinus wide and shallow; canal straight and produced. Length 26 mm., breadth 9 mm.

Specimens of *Pleurotoma tuberculata* Gray, from Bombay and Karachi, differ from *T. granobalteus* by more prominent sculpture, and especially by the beads on the base. According to Melvill's figure the new species resembles *P. nellie*, but differs in colour and the larger number of peripheral beads.

*Hab.* Queensland:—Karnmba, mouth of Norman River (type); Forsyth Island and Mapoon, all in the Gulf of Carpentaria (self); 11 fathoms, Cape York (Brazier).

INQUISITOR HEDLEYI *Verco*.

*Drillia hedleyi* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 302, pl. xxvi., fig. 6.

*Hab.* South Australia:—200 fathoms, Beachport (type); 90 fathoms, Cape Jaffa; 104 fathoms, Neptune Islands (Verco).

INQUISITOR HOLOLEUCUS *Odhner*.

*Drillia hololeuca* Odhner, Kungl. Sv. Vet. Akad. Handl., lii., 1917, p. 58, pl. ii., fig. 61.

This has a general resemblance to *I. fibratus*, but differs in detail of sculpture.

*Hab.* Western Australia:—12 fathoms, 45 miles W.S.W. of Cape Jaubert (Mjöberg).

INQUISITOR IMMACULATUS *Tenison-Woods*.

(Plate xlv., fig. 31.)

*Mangelia immaculata* Tenison-Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 142, and 1877 (1879), p. 27. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1815, p. 66.

*Drillia immaculata* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369.

*Drillia gabrieli* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 100, pl. viii., fig. 1.

My figure is from a specimen 17 mm. in length, which Mr. W. L. May kindly compared with the type for this purpose of illustration. The type itself is bleached and worn, and has lost details of sculpture. Victorian specimens are buff, but one taken off Sydney Heads by Mr. J. Brazier is chocolate-brown.

*Hab.* Tasmania:—King Island, type of *immaculata* (Tasmanian Museum). Victoria:—5 fathoms, Western Port, type of *gabrieli* (Gabriel). N.S. Wales:—Off Sydney Heads (Brazier).

INQUISITOR LACERTOSUS *sp. nov.*

(Plate xlv., fig. 32.)

Shell solid, biconical. Whorls six, of which two compose the protoconch. Colour salmon-buff, ribs cream; a few scattered ferruginous dots and large square ferruginous spots in the intercostal spaces. Ribs low, tubercular, projecting in an acute angle from the shoulder; nine on the last whorl. Sometimes elevated crescentic lamellæ extend from these ribs to the suture; other lamellæ continue as fine growth lines across the shell. The spirals are faint threads, evanescent on the shoulder and prominent on the snout. Of these there are about forty on the last whorl, twelve of which are posterior to the angle. Aperture simple and unfinished in the only example available. Length 13 mm., breadth 7 mm.

*Hab.* N.S.Wales:—50 fathoms, off Point Plomer (type, self).

INQUISITOR LASSULUS *sp. nov.*

(Plate xlv., fig. 33.)

*Drillia varicosa* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 152 (not *Pleurotoma varicosa* Reeve).

Shell of moderate size, solid, rather glossy, fusiform. Colour buff, chequered with ochre-red, disposed irregularly, though alternate segments of red and buff on the subsutural cord seems a constant feature; usually the snout, the fasciole, and a narrow supra-basal zone are buff, while the intercostal spaces and a broad basal zone are red. Whorls ten, of which two include the protoconch. Sculpture:—A prominent undulating cord runs beneath the suture, and is followed by a rather narrow fasciole with a median groove; the ribs may, or may not, swell at irregular intervals into varices—they are stout, perpendicular, discontinuous, persistent on the last whorl, and reach to the base; they are set at about eleven to the whorl; spirals are flat-topped cords, their width apart, more prominent in the interspaces than on the ribs, their interstices and sometimes themselves crossed by a secondary sculpture of fine radial threads, excluding the subsutural spiral; there are fourteen on the last whorl, and two or three on the earlier whorls. Aperture:—Mouth narrow, last varix twice its breadth behind the edge of the lip; sinus open, wide, and deep; columella straight, inner lip with a raised margin; canal produced and recurved. Length 15 mm., breadth 5 mm.

Compared with *I. varicosa*, for which Brazier mistook it, this species is shorter, stouter, and with less and fewer varices. *I. sterrha* is twice the size, more brightly and differently coloured, with broader, rounder, and closer ribs. *I. spaldingi* is more like it, but apart from the different colour scheme. *I. lassulus* is smaller, with more prominent ribs, and may be distinguished especially by the conspicuous and chequered subsutural ridge.

*Hab.* Queensland:—8 fathoms, Weary Bay (type); 15 fathoms, Palm Island (self); 20 fathoms, Darnley Island; 16 fathoms, York Island; 11 fathoms, Palm Island (Brazier); 20 fathoms, between Cairns and Endeavour Reef (McCulloch).

INQUISITOR LATERCULATUS *Sowerby*.

*Pleurotoma laterculata* Sowerby, Proc. Zool. Soc., 1870, p. 253. *Id.* Smith, Zool. Coll. "Alert," 1884, p. 38, pl. iv., fig. E. *Id.* Watson, Chall. Zool. Rep., xv., 1886, p. 303, pl. xviii., fig. 5.

*Drillia laterculata* Schepman, Siboga Exped., Monogr. xlix., 1913, p. 408.

*Hab.* Queensland:—12 to 20 fathoms, Port Molle (Coppinger); 25 fathoms, west of Cape York ("Challenger")

INQUISITOR MASTERSI *Brazier*.

*Drillia mastersi* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 153. *Id.* Hedley, Rec. Austr. Mus., iv., 1901, p. 121.

*Pleurotoma (Drillia) essingtonensis* Smith, Ann. Mag. Nat. Hist., (6), ii., 1888, p. 303.

*Drillia essingtonensis* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1908, p. 487, pl. viii., fig. 8.

The type shells of *I. mastersi* are immature; being concealed in the Chevert collection under an unpublished name, they escaped recognition when I formerly examined the collection.

*Hab.* Queensland:—8 fathoms, Warrior Island, Torres Straits (type, Brazier); 4 to 14 fathoms, Albany Passage; 7 to 10 fathoms, Port Curtis; Mast Head Reef (self). Northern Territory:—Port Essington, type of *essingtonensis*.

INQUISITOR METCALFEI *Angas*.

(Plate xliv., figs. 34, 35.)

*Drillia metcalfei* Angas, Proc. Zool. Soc., 1878, pp. 113, 203, pl. xiii., fig. 16. *Id.* Brazier, Rep. Austr. Mus. for 1881 (1883), p. 22. *Id.* Brazier, Journ. of Conch., vi., 1889, p. 70.

*Pleurotoma metcalfei* Smith, Proc. Zool. Soc., 1879, p. 189. *Id.* Watson, Chall. Rep. Zool., xv., 1886, p. 304.

The type is a faded shell in the British Museum. This species varies in size, colour, and sculpture. It reaches a length of 20 mm., with nineteen tubercules on the penultimate whorl, and is usually dark chestnut picked out with buff on the shoulder nodules. The operculum (fig. 35) is unguiculate with a terminal nucleus.

*Hab.* N. S. Wales:—Port Jackson (type, Angas); Port Stephens (Brazier).

INQUISITOR MULTILIRATUS *Smith*.

(Figure 6.)

*Pleurotoma (Drillia) multilirata* Smith, Ann. Mag. Nat. Hist., (4), xix., June 1877, p. 496.

*Drillia multilirata* Hedley, Mem. Austr. Mus., iv., 1903, p. 389, text fig. 102 (not 103).

Herewith is figured a specimen from 300 fathoms, off Sydney, which is doubtfully ascribed to this species.

*Hab.* N.S. Wales:—Port Jackson (type, British Museum); 80 fathoms, 22 miles east of Narrabeen; 300 fathoms, 27 miles east of Sydney (self).



Fig. 6.

INQUISITOR PETILINUS *sp. nov.*

(Plate xlv., fig. 36.)

Shell lanceolate, sub-turreted, thin, surface smooth and glossy. Colour buff-yellow, with two zones of raw sienna, the one subsutural, the other peripheral. Whorls ten, of which two constitute the protoconch. Prominent round-backed ribs, arranged at ten to a whorl, follow each other irregularly up the spire. On the upper whorls the spirals are evanescent, and are represented by two or three beads on the ribs. On the last whorl there are about fifteen slight wide-spaced threads. Fasciole indistinct. Aperture—sinus semi-circular; lip simple, slightly bent inwards; canal short, slightly recurved. Length 12.5 mm., breadth 4.6 mm.

*Hab.* N. S. Wales:—Jervis Bay (type, Brazier).

INQUISITOR RADULA *Hinds*.

*Pleurotoma radula* Hinds, Proc. Zool. Soc., 1843, p. 38. *Id.* Hinds, Zool. "Sulphur," ii., 1844, p. 16, pl. v., fig. 9. *Id.* Reeve, Conch. Icon., i., 1845, pl. xxv., fig. 223.

*Drillia radula* Angas, Proc. Zool. Soc., 1867, p. 202. *Id.* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 153. *Id.* Schepman, Siboga Exped., Monogr. xlix., 1913, p. 413. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 157.

*Turris radula* Cooke, Ann. Mag. Nat. Hist., (5), xvi., 1885, p. 34.

*I. radula* is closely related to the Sydney *I. macleayi*, but is shorter, stouter, more solid, and more harshly sculptured.

*Hab.* Queensland:—20 to 30 fathoms, Darnley Island; 20 fathoms, Cape Grenville (Brazier); 7 to 10 fathoms, Port Curtis; 4 to 14 fathoms, Albany Passage (self).

INQUISITOR RADULIFORMIS *Weinkauffi* (emend.)

*Pleurotoma* (*Sargula*) *raduliformis* Weinkauff, *Conch. Cab.*, 1876, p. 91, pl. xix., fig. 7, 8.

This species is unknown to Australian conchologists; apparently it resembles *I. metcalfei*. The type is probably in the Hamburg Museum.

*Hab.* Tasmania:—Bass Strait (type, Godeffroy Museum).

INQUISITOR SENRADIATUS *Odhner*.

*Drillia senradiatus* Odhner, *Kung. Sv. vet. Akadem. Handl.*, lii., 1917, p. 57, pl. ii., fig. 59.

*Hab.* Western Australia:—8 fathoms, 45 miles W.S.W. of Cape Jaubert (Mjöberg).

INQUISITOR SPADIX *Watson*.

*Pleurotoma* (*Drillia*) *spadix* Watson, *Chall. Rep. Zool.*, xv., 1886, p. 310, pl. xxvi., fig. 6.

*Drillia spadix* Hedley, *Mem. Austr. Mus.*, iv., 1903, p. 388.

*Hab.* N.S.Wales:—35 fathoms, off Sydney (type, "Challenger"); 63 to 75 fathoms, Port Kembla ("Thetis"). Victoria:—80 fathoms, Gabo Island ("Endeavour").

INQUISITOR SPALDINGI *Brazier*.

*Drillia spaldingi* Brazier, *Proc. Linn. Soc. N.S.W.*, i., 1876, p. 153. *Id.* Hedley, *Rec. Austr. Mus.*, iv., 1901, p. 122, pl. xvi., fig. 1.

An orange splash on the back of the last whorl is a useful recognition mark for this species.

*Hab.* Queensland:—11 fathoms, Bet Island; 30 fathoms, Darnley Island (Brazier).

INQUISITOR SPURIOUS *nomen nudum*.

*Pleurotoma tuberculata* Gray, *Beechey's Voyage*, 1839, p. 120. *Id.* Reeve, *Conch. Icon.*, i., 1843, pl. ix., fig. 72. *Id.* Weinkauff, *Conch. Cab.*, 1875, p. 40, pl. ix., figs. 1, 3. *Id.* Dunker, *Index Moll. Mar. Jap.*, 1882, p. 20. *Id.* Watson, *Chall. Rep. Zool.*, xv., 1886, p. 285. *Id.* Melvill, *Proc. Malac. Soc.*, xii., 1917, p. 164 (not *Pleurotoma tuberculata* Pusch, *Polens Palæontologie*, 1837, p. 143, pl. xii., fig. 2. nor *Pleurotoma tuberculata* Anton, *Verzeich. Conch.*, 1839, p. 72).

*Pleurotoma punctata* Reeve, *Proc. Zool. Soc.*, 1845 (1846), p. 111. *Id.* Reeve, *Conch. Icon.*, i., 1845, pl. xxi., fig. 18. *Id.* Brazier, *Proc. Linn. Soc. N.S.W.*, i., 1876, p. 151 (not *Pleurotoma punctata* Schubert and Wagner, *Conch. Cab.*, xii., 1829, p. 155).

*Hab.* Queensland:—20 to 30 fathoms, Darnley Island (Brazier). Arafura Sea ("Challenger").

INQUISITOR STERRHUS *Watson*.

- Pleurotoma sterrha* Watson, Journ. Linn. Soc., Zool., xv., 1881, p. 426.  
*Id.* Watson, Chall. Zool. Rep., xv., 1886, p. 305, pl. xxi., fig. 3.  
*Id.* Hedley, Proc. Linn. Soc. N.S.W., xxx., 1906, p. 534.  
*Drillia sterrha* Schepman, Siboga Exped., Monogr. xlix., 1913, p. 413.  
*Pleurotoma torresiana* Smith, Zool. "Alert," 1884, p. 37, pl. iv., fig. D.  
*Drillia torresiana* Melvill and Standen, Journ. Linn. Soc., Zool., xxvii., 1899, p. 156.  
*Drillia sinensis* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 152 (not *Clavatula sinensis* Hinds).

This species is proposed as genotype of *Inquisitor*. A typical specimen which I dredged in the Gulf of Carpentaria is 39 mm. long and 13 mm. broad, with fourteen ribs on the last whorl. At Rat Island, Port Curtis, Dr. R. Pulleine obtained a variety which is more slender and closely ribbed, being 28 mm. long, 8 mm. broad, and has seventeen ribs on the last whorl.

*Hab.* Queensland:—3 to 12 fathoms, Cape York (type of *sterrhus*, "Challenger"); 7 to 9 fathoms, Friday Island (type of *torresiana*, "Alert"); Albany Passage (Haddon); Bowen (Haswell); Port Curtis (Pulleine); 5 to 8 fathoms, Mapoon; Murray Island; 15 fathoms, Palm Island (self); 13 fathoms, Cape Grenville (Brazier); between Cairns Reef and Endeavour Reef (McCulloch).

INQUISITOR SUAVIS *Smith*.

(Plate xlv., fig. 37.)

- Pleurotoma (Drillia) suavis* Smith, Ann. Mag. Nat. Hist., (6), ii., 1888, p. 305. *Id.* Dautzenberg, Proc. Malac. Soc., vi., 1904, p. 131 (not *Drillia suavis* Hervier, Journ. de Conch., xliii., 1895, p. 141).  
*Drillia prosuavis* Hedley, Mem. Austr. Mus., iv., 1903, p. 339, text fig. 103, not 102.

A disputed point in nomenclature here involved was tried by a conchological jury. Though their verdict differs from my opinion, it is here dutifully accepted.

*Hab.* N.S.Wales:—41 to 50 fathoms, Cape Three Points ("Thetis"); 24 fathoms, Broughton Island (Museum Expedition). Victoria:—Western Port (Gabriel).

INQUISITOR TAYLORIANUS *Reeve*.

- Pleurotoma tayloriana* Reeve, Conch. Icon., i., 1846, pl. xl., fig. 152. *Id.* Melvill and Standen, Journ. of Conch., ix., 1898, p. 37.  
*Drillia tayloriana* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 152. *Id.* Böttger, Nachr. Malak. Gesell., xxvii., 1895, p. 6. *Id.* Melvill and Standen, Proc. Zool. Soc., 1901, p. 440. *Id.* Hidalgo, Revist. Acad. Cienc. Madrid, i., 1904, p. 334. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 159.

*Hab.* Queensland:—30 fathoms, Darnley Island (Brazier); 5 to 10 fathoms, Hope Island (self).



INQUISITOR VARICOSUS *Reeve*.

*Pleurotoma varicosa* Reeve, Conch. Icon., i., 1843, pl. xvi., fig. 144. *Id.* Reeve, Proc. Zool. Soc., 1843 (1844), p. 187. *Id.* Hidalgo, Revist. Acad. Cienc. Madrid, i., 1904, p. 334. *Id.* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 410. *Id.* Odhner, Kung. Sv. Vet. Akad. Handl. lii., 1917, p. 57, pl. ii., fig. 60.

Possibly this record is based on *I. stercha*.

*Hab.* Western Australia:—12 fathoms, 45 miles W.S.W. of Cape Jaubert (Mjöberg).

AUSTRODRILLIA *Hedley*.

*Austrodrillia* Hedley, Journ. Roy. Soc. N.S.W., ii., 1918, p. M 79.

Shell small, very solid, subcylindrical or claviform. Sculpture of nodose ribs that do not attain the suture, and fine spiral threads which are most dense at the summit of the whorl. No epidermis. Protoconch of two smooth and elevate whorls. Aperture wide, without varix or internal armature. Outer lip simple. Sinus wide, U-shaped, its right margin resting on a massive insertion callus. Fasciole indistinguishable. Type *Pleurotoma angasi* Crosse, 1863.

This genus appears to be represented in South Africa by such forms as *Pleurotoma caffra* and *P. hottentota* Smith, and in New Zealand by *Drillia lyallensis* Murdoch.

AUSTRODRILLIA ACHATINA *Verco*.

*Drillia achatina* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 299, pl. xxvi., fig. 2.

*Hab.* South Australia:—20 fathoms, Newland Head (type): 40 fathoms, Beachport: 55 fathoms, Cape Borda (Verco).

AUSTRODRILLIA AGRESTIS *Verco*.

*Drillia agrestis* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 299, pl. xxvii., fig. 7.

*Hab.* South Australia:—40 fathoms, Beachport (type): 17 fathoms, Backstairs Passage (Verco).

AUSTRODRILLIA ANGASI *Crosse*.

(Plate xliv., figs. 38, 39.)

*Pleurotoma angasi* Crosse, Journ. de Conch., xi., 1863, p. 87, pl. i., fig. 5.

*Drillia angasi* Angas, Proc. Zool. Soc., 1867, p. 203. *Id.* Tryon, Man. Conch., vi., 1884, p. 187, pl. ix., fig. 37. *Id.* Brazier, Journ. of Conch., vi., 1889, p. 71. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxi., 1908, p. 375.

Tryon incorrectly united this with *A. berandiana*, but they are clearly separable. *A. angasi* has the intercostal spaces coloured chocolate. *A. berandiana* is a stouter, shorter shell, with fewer, more widely spaced ribs. In the British Museum seven specimens are marked as types of *A. angasi*.

This species does not occur in New Zealand. The name of *Austro-drillia raritensis* is now proposed for a species from the Bay of Islands, which Mr. Suter has mistakenly figured and described<sup>41</sup> as *Drillia angasi*. The New Zealand species differs from the real *angasi* by shorter, broader form, orange-brown colour, shorter ribs, and deep conspicuous spiral grooves.

*Hab.* N.S.Wales:—Port Jackson (type, Angas); Catherine Hill Bay (R. L. Cherry); Gerringong and Wreck Bay (self). Victoria:—San Remo (Mrs. A. F. Kenyon).

#### AUSTRODRILLIA BERAUDIANA Crosse.

(Plate xlv., fig. 40.)

*Plenrotoma berandiana* Crosse, Journ. de Conch., xi., 1863, p. 88, pl. i., fig. 6. *Id.* Weinkanff, Conch. Cab., 1876, p. 95, pl. xx., figs. 7, 8. *Id.* Tenison-Woods, Proc. Roy. Soc. Tasm., 1877 (1878), p. 27.

*Drillia berandiana* Angas, Proc. Zool. Soc., 1867, p. 203. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Viet., xii., 1900, p. 171.

? *Drillia tenuata* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 36. *Id.* Hardy, *op. cit.*, 1915, p. 69.

In the British Museum seven specimens are marked as the types of *A. berandiana*. By Pritchard and Gatliff *Drillia tenuata* Tenison-Woods is classed under *G. picta*, but by Tate and May under *A. berandiana*.

*Hab.* N.S.Wales:—Port Jackson (type, Angas); Catherine Hill Bay (R. L. Cherry); Twofold Bay (self). Victoria:—Port Phillip and Western Port (Gabriel). Tasmania:—King Island (Tenison-Woods); East Coast (May).

#### AUSTRODRILLIA DIMIDIATA Sowerby.

*Drillia dimidiata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 24, pl. xiii., fig. 2. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 297.

*Hab.* South Australia:—16 fathoms, Backstairs Passage (type); 19 fathoms, Yankalilla Bay; 40 fathoms, Beachport (Verco).

<sup>41</sup> Suter—Man. N. Zealand Mollusca, 1913, p. 480, pl. 46, fig. 25.

*AUSTRODRILLIA NENIA Hedley.*

(Figure 7.)

*Drillia nenia* Hedley, Mem. Aust. Mus., iv., 1903, p. 387, text fig. 101. *Id.* Hedley, Rec. Austr. Mus., vi., 1905, p. 42. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 74. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Viet., xxvi., 1913, p. 74.

*Austrodrillia nenia* May, Check List Mollusca, Tasmania, 1921, p. 76.

*Hab.* N. S. Wales:—24 fathoms, Port Stephens (type); 22 fathoms, Manning Head; 50 fathoms, Cape Three Points; 54 fathoms, Wata Mooli; 75 fathoms, Port Kembla ("Thetis"); 111 fathoms, Cape Byron (Halligan). Victoria:—40 fathoms, Ninety-mile Beach (Gatliff). South Australia:—200 fathoms, Beachport (Verco).



FIG. 7.

*AUSTRODRILLIA SAXEA Sowerby.*

*Drillia saxea* Sowerby, Proc. Malac. Soc., ii., 1896, p. 25, pl. iii., fig. 4. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., p. 304. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Viet., xxvi., 1913, p. 74.

*Hab.* South Australia:—St. Vincent Gulf (type); 40 to 200 fathoms, Beachport; 90 to 300 fathoms, Cape Jaffa; 55 fathoms, Cape Borda (Verco). Tasmania:—100 fathoms, Cape Pillar; 40 fathoms, Schouten Island (May). Victoria:—Wilson's Promontory (Gatliff and Gabriel).

*AUSTRODRILLIA SUBLICATA Verco.*

*Drillia sublicata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 300, pl. xxvii., fig. 6.

*Hab.* South Australia:—40 fathoms, Beachport (type); 130 fathoms, Cape Jaffa (Verco).

## Sub-family CLAVATULINÆ.

*MELATOMA Swainson.*

*Melatomia* Swainson, Treatise Malacology, 1840, pp. 202, 342, text fig. 104; type *M. costata* Swainson. *Id.* Dall, Proc. U.S. Nat. Museum, liv., 1918, p. 317.

*Clionella* Gray, Proc. Zool. Soc., 1847, p. 153; type *Buccinum sinuatum* Born. *Id.* Stimpson, Am. Journ. Conch., i., 1865, p. 62, pl. ix., fig. 13, *radula*. *Id.* Bartsch, U.S. Nat. Mus. Bull., 91, 1915, p. 14.

Sir Joseph Vereo observed<sup>2</sup> that the operculum of *Drillia harpactor* requires the transference of that species from *Turritella* to *Clavatulina*. Agreeable to the suggestions of Weinkauff and Vereo, and pending further information on the opercular and other characters, the following Australian species are therefore tentatively grouped in a *Clavatulina* genus. *Drillia huttoni* Hutton, from New Zealand, may be included here.

*M. huttoni* (Hutton) and *M. huttoni* are distinguished from the rest by a particularly glossy surface, and absence of the usual spirals. To these *Drillia* *huttoni* Hutton, from south New Zealand, is related. To contain these I propose a new sub-genus—*Sphaerodonta*, with *M. huttoni* for type.

MEIATOMA BEDNAULTI Sowerby.

*Drillia bednaulti* Sowerby, Proc. Malac. Soc., ii., 1896, p. 25, pl. iii., fig. 3.  
*Drillia* Tate and May, Proc. Linn. Soc. N.S.W., xxvii., 1901, p. 368. *Drillia* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 302.

*Hab.*—South Australia:—St. Vincent Gulf (type); 20 fathoms, St. Francis Island (Vereo).

MEIATOMA DAMPIERII Sowerby.

(Plate xlv., fig. 41.)

Shell slender lanceolate, long, and solid. Colour uniform livid-brown to russet-vinaceous. Whorls eleven, including a mucronate protoconch of two whorls. Sculpture:—Surface in general polished; the fasciole a broad and rather deeply sunken furrow, crossed by fine concentric growth lines, and traversed by a median sulcus; above it runs a prominent sub-sutural ridge; between the fasciole and the anterior end are twenty-two spiral grooves, which grow wider and deeper towards the base, and smaller and more crowded on the snout; the radial ribs are seventeen to a whorl, prominent on the shoulder, and gradually vanishing towards the base, higher on the penultimate, and decreasing towards the aperture. Aperture pyriform; lip simple; sinus U-shaped, rather large; a boss or callus near the insertion of the lip and a separate sheet of callus on the lower columella; canal short and wide. Length 30 mm., breadth 9 mm.

This species resembles *M. huttoni*, but is much larger, purplish in colour, with weaker radials but stronger spiral sculpture.

*Hab.*—Western Australia:—Shark Bay (type in Macleay Museum).

MEIATOMA BULLARII Sowerby.

(Plate xlv., fig. 42.)

Shell small, solid, lanceolate. Colour dull cream, with a faint dorsal zone of brown. Whorls eight, including a two-whorled protoconch. Sculpture:—The radials are smooth round-backed perpendicular ribs,

<sup>2</sup> Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 296.

truncated by a smooth and constricted fasciole, amounting to eleven on the penultimate; on the earlier part of the body-whorl these ribs are smaller and closer together than previously; half a whorl behind the aperture is a rough varix, beyond which the ribs cease; spirals—on the base are about a dozen fine grooves; between the suture and the fasciole is a spiral ridge which tends to break up into beads opposite the ribs. Aperture narrow; sinus C-shaped; a thick callus knob occurs at the right insertion. Length 8 mm., breadth 3 mm.

*Hab.* Queensland:—5 fathoms, off the Horsey River, Gulf of Carpentaria (type, self).

*MELATOMA EBURNEA* *sp. nov.*

(Plate xlv., fig. 43.)

Shell solid, glossy, cylindro-fusiform. Colour uniform ivory-yellow. Whorls seven, including a two-whorled dome-shaped protoconch. Suture impressed. Sculpture:—There are no spirals; the ribs are set about fourteen to a whorl—they start up suddenly, immediately below the contracted fasciole area, are prominent, perpendicular, wide-spaced, discontinuous, decreasing anteriorly, become obsolete on the last whorl, and vanish below the periphery. Aperture wide; no varix; lip simple; sinus deep. U-shaped, right insertion incrassate; throat smooth; inner lip overlaid with a thick polished callus; canal short and open. Length 10 mm., breadth 4 mm.

This is like *Drillia lævis* Hutton, but is much smaller, with sharper and more numerous ribs.

*Hab.* N.S. Wales:—55 fathoms, Wollongong ("Thetis"). Victoria:—80 fathoms, Gabo Island (type, "Endeavour").

*MELATOMA GRATIOSA* *Sowerby.*

*Drillia gratiosa* Sowerby, Proc. Malac. Soc., ii., 1896, p. 25, pl. iii., fig. 1.

*Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 302.

*Hab.* South Australia:—St. Vincent Gulf (type); 17 fathoms, Point Marsden; 22 fathoms, Kangaroo Island; 49 fathoms, Beachport (Verco).

*MELATOMA HARFULARIA* *Des Moulins*

*Pleurotoma harpula* Kiener, Coq. Viv., 1840, p. 58, pl. xviii., fig. 3.

*Crassispira harpula* Menke, Yoldi Cat., 1853, p. 73 (not *Murex harpula* Brocchi, Conch. foss. subapenn., 1814, p. 421, pl. viii., fig. 12, nor *Pleurotoma harpula* Deshayes, Descrip. Coq. Foss. Paris, ii., 1834, p. 490, pl. lxvii., figs. 22, 23, 24).

*Pleurotoma harfularia* Des Moulins, Act. Soc. Linn. Bordeaux, xii., 1842, p. 162. *Id.* Reeve, Conch. Icon., i., 1843, pl. xv., fig. 124.

*Drillia harpularia* Angas, Proc. Zool. Soc. 1865, p. 159. *Id.* Tate, Trans. Phil. Soc. Adelaide, ii., 1879, p. 137. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 24. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 170. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 296.

Since the type was obtained by the "Astrolabe," it probably came from King George Sound. The Adelaidean example differs from the type by smaller size and tawny colour.

A relation of this species is *Drillia annula* Angas, really a native of Stewart Island, New Zealand, but erroneously ascribed by its author to N.S.Wales.<sup>43</sup>

*Hab.* Victoria:—Portland (Pritchard). South Australia:—St. Vincent Gulf to St. Francis Island (Verco). Western Australia:—King George Sound (Tate). New Holland:—Tigre Bay (British Museum).

MELATOMA LYGDINA *sp. nov.*

(Plate xlv., fig. 44.)

Shell thin, lanceolate, subturreted, spire produced, base constricted. Colour uniform yellowish-gray. Whorls exceeding ten. Sculpture:—The fasciole is only indicated by the even truncation of the ribs; surface smooth, so that a few microscopic growth scratches are only just perceptible; the ribs are prominent, short, oblique, wave-shaped, spaced about twelve to a whorl; just behind the aperture the ribbing becomes irregular, the place of a final rib being taken by three small riblets which coalesce above. Aperture pyriform; sinus U-shaped, rather deep. Length 27 mm., breadth 8.5 mm.

This species is represented by a single specimen with an imperfect apex.

*Hab.* Victoria:—150 to 200 fathoms, off Gabo Island ("Endeavour").

MELATOMA SPADICINA *sp. nov.*

(Plate xlv., fig. 45.)

Shell large, solid, elongate-conic, regularly tapering. Colour cinnamon-brown. Whorls ten. Suture linear. Sculpture:—Below the suture runs an elevated spiral cord; in the intervals between the ribs and on the base are fine spiral threads; the fasciole area is excavate, ornamented with fine spiral threads crossed by concentric striae; the ribs are fourteen to a whorl, oblique, round-backed, commencing below the fasciole and vanishing on the base. Aperture pyriform; insertion of lip ascending above the plane of the suture, and supported by a prominent callus knob; inner lip a smear of callus; sinus rather wide and shallow; canal short and open. Length 25 mm., breadth 8 mm.

<sup>43</sup> Hedley—Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 311.

The material for this description has been gathered among storm drift on ocean beaches, and is worn or broken. This species has a general resemblance to *M. harpularia*, but differs by being larger, of more slender proportions, more contracted at the base, with less prominent radials and with spiral threads.

*Hab.* N.S. Wales :—Woolgoolga (type, C. Laseron); Little River (Brazier); Catherine Hill Bay (R. L. Cherry); Thirroul (Mrs. N. Barnett).

*MELAIOMA SUBVIRIDIS* May.

*Drillia subviridis* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 392, pl. xiv., fig. 18.

*Hab.* Tasmania :—9 fathoms, Derwent Estuary (type); 40 fathoms, Schouten Island (May). Victoria :—80 fathoms, Gabo Island ("Endeavour").

*MELAIOMA WOODSI* Beddome.

*Drillia woodsi* Beddome, Proc. Roy. Soc. Tasm., 1882 (1883), p. 167. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 368. *Id.* Hedley, Mem. Austr. Mus., iv., 1903, p. 388. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 301.

*Drillia howitti* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, pp. 101, 172, pl. viii., fig. 2. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxv., 1901, p. 722.

*Hab.* Tasmania :—D'Entrecasteaux Channel (type, Beddome); Fredrick Henry Bay (May). Victoria :—Gippsland Coast (Pritchard). South Australia :—Middleton; 300 fathoms, Cape Jaffa; 200 fathoms, Beachport (Verco). N.S. Wales :—Sydney; 22 fathoms, Manning Heads; 24 fathoms, Broughton Islands; 50 fathoms, Botany Heads ("Thetis").

Var. *ACOSTATA* Verco.

Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 301.

*Hab.* South Australia :—200 fathoms, Beachport; 130 fathoms, Cape Jaffa (Verco).

*TURRICULA* Schumacher.

*Turricula* Schumacher, Essai Nouv. Syst. Vers. test., 1817, p. 217, type *T. plumbea* Schumacher=*Murex tornatus* Dillwyn, Chemnitz, Conch. Cab., iv., pl. cxliii., fig. 1336-8. *Id.* Iredale, Proc. Malac. Soc., xii., 1917, p. 324.

*Succula* H. and A. Adams, Gen. Rec. Moll., i., 1853, p. 88.

The brothers Adams introduced *Succula* to replace Schumacher's name, on the mistaken plea that it was preoccupied by Klein. References to *Turricula* previous to 1817 are invalid for nomenclature, and the

general use of the name in the *Mitridae* was unfortunate. In size and contour the shell resembles that of *Turris*, but is broader. The peripheral keel is beaded either in the young stage, as in the genotype, or throughout life. A superficial resemblance to *Gemmula* is acquired by the beaded periphery, but the position of the sinus differentiates it from the genera. Eydoux and Souleyet have shown that the operculum of *Pleurotoma nodifera* has a lateral nucleus, thus conveying the genus to the *Clavatulinae*. *Turris conspicua* and *T. altispira*,<sup>41</sup> Tasmanian Tertiary fossils, may belong to this genus.

TURRICULA JAVANA Linne.

*Mitra javanus* Linne, Syst. Nat., xii., 1767, p. 1221. *Id.* Hanley, Ips. Linn. Conch., 1885, p. 299.

*Sarcula javana* Standen and Leicester, Ceylon Pearl Oyster Reports, xxxviii., 1906, p. 287.

*Drillia (Sarcula) javana* Shirley, Proc. Roy. Soc. Queensland, xxix., 1917, p. 112 (not *P. javana* of Gmelin, Reeve, &c.)

*Murex turris* Gmelin Syst. Nat., xiii., 1791, p. 3543.

*Pleurotoma contorta* Perry, Conchology, 1811, pl. xxxii., fig. 1.

*Pleurotoma nodifera* Lamarek, An. s. vert., vii., 1822, p. 96. *Id.* Crouch, Introduc. Lam. Conch., 1827, p. 33, pl. xvii., fig. 4. *Id.* Kiener, Coq. Viv., Pleurotome, 1840, p. 22, pl. xii., fig. 1. *Id.* Deshayes, An. s. vert., 2 ed., ix., 1843, p. 353. *Id.* Reeve, Conch. Icon., i., 1843, pl. iv., fig. 28. *Id.* Souleyet, Zool. "Bonite," ii., 1852, p. 620, pl. xlv., figs. 6-7-8.

I have seen no Australian example of this species.

*Hab.* Queensland:—Thursday Island (Shirley).

TURRICULA LEPTA Watson.

*Pleurotoma (Sarcula) lepta* Watson, Journ. Linn. Soc., xv., 1881, Zool. p. 391. *Id.* Watson, Chall. Rep. Zool., xv., 1886, p. 288, pl. xviii., fig. 7.

*Hab.* South-west Australia:—1,950 fathoms, S. lat. 53.55, E. long. 108.35 ("Challenger").

CLAVUS Montfort.

*Clavus* Montfort, Conch. Syst., ii., 1810, p. 435, pl. cix., type *Clavus flammulatus* Montfort = *Strombus lividus* Linne = *Clavatula echinata* Lamarek. *Id.* Cossman, Essai. Paleconch., ii., 1896, p. 86. *Id.* Dall, Proc. U.S. Nat. Mus., liv., 1918, pp. 315, 324.

*Clavicantha* Swainson, Treat. Malac., 1840, pp. 155, 314, type selected by Herrmannsen, Ind. Gen. Malac., i., 1846, p. 246, *Pleurotoma echinata* Lamarek.

*Tylothia* Melvill, Proc. Malac. Soc., xii., 1917, p. 160, type *Strombus canalicularis* Bolten = *Clavatula auriculifera* Lamarek.

<sup>41</sup> May—Proc. Roy. Soc. Tasm., 1921, pp. 11, 12, pl. iv., figs. 7, 8.



The shell of *Clavus* is characterised by the following features: Flat indefinite fasciole, indicated only by the curve of growth lines; a smooth subulate protoconch. An insinuation of the outer lip, near the base, like that of *Strombus*; a major sculpture of prominent arched scales on the shoulder, and a minor sculpture of dense, microscopic, waved, spiral striae. The animal was figured by Quoy and Gaimard in the atlas of the zoology of the *Astrolabe*.<sup>45</sup> An operculum of *C. ridgwayioides* Garrett from Cebu, Philippines, is here shown (Pl. xlv., fig. 51) to have a medio-lateral nucleus.

The specific identity of the genotype *Strombus lividas* was left in doubt by Hanley<sup>46</sup> when he studied the Linnean collection, and it has not been decided since. I therefore wrote to Dr. Nils H. Odhner, of the National Museum of Sweden, inquiring if he could obtain any information on the subject. He kindly replied (21st February, 1918) that he had in turn referred to Professor Wren, in charge of the museum at Uppsala, where the Linnean types are, who answered: "A specimen labelled by Thunberg as *Strombus lividas*, Mus. Gust. Ad., is present here, and it may be considered with great probability to be the same as Linne described in the Mns. Ludovicae Ulricae, 1764." This type specimen was submitted to Dr. Odhner, who described it as corresponding in shape, size, and colour to *Pleurotoma echinata*, as figured by Reeve.<sup>47</sup> The identifications of *Strombus* by Chemnitz and Solander<sup>48</sup> are thus shown to be erroneous.

*CLAVUS EXEUS* *sp. nov.*

(Plate xlv., fig. 46.)

Shell small, solid, cylindro-fusiform, polished, constricted at the sutures. On decollate specimens six whorls remain, divided by linear sutures. Colour amber-brown, with ochraceous reflections. Sculpture:—Ribs prominent, arcuate, each slightly overhanging the one below, seven to a whorl, consecutive on the spire, smaller on the last whorl where they do not reach the base; on the base and snout are six revolving threads. Aperture rather wide, flanked by a tall and thick varix; edge of lip thin, insinuate at the base; columella perpendicular and concave; canal short and wide; sinns wide and shallow; a prominent callus knob at the lip insertion. Length 11 mm., breadth 4 mm.

This resembles *Clavus fuscomitens* Sowerby, but is much smaller, proportionately narrower, with fewer and more prominent ribs.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*CLAVUS CANDIDULUS* *sp. nov.*

(Plate xlv., fig. 47.)

*Clathurella quisqualis* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 157 (not *Clavatula quisqualis* Hinds, Zool. Sulphur, ii., 1844, p. 19, pl. vi., fig. 5).

<sup>45</sup> Quoy and Gaimard—Pl. xxxv., fig. 9.

<sup>46</sup> Hanley—Ips. Linn. Conch., 1855, p. 278.

<sup>47</sup> Reeve—Conch. Icon., i., 1843, pl. vi., fig. 48.

<sup>48</sup> Iredale—Proc. Malac. Soc., xii., 1916, p. 192.

Shell small, subcylindrical, solid, and very glossy. Colour ice-white. Whorls seven, inclusive of the protoconch—a small smooth dome of two whorls. Sculpture:—The only spirals are four lines on the snout: ribs broad and low, crowded above, and becoming more spaced as growth proceeds; evanescent on the last half whorl, discontinuous from whorl to whorl, amounting to eight on the penultimate, sometimes lightly impressed and sometimes interrupted by the fasciole, which is not otherwise apparent. Suture sinuate. Aperture fusiform; outer lip expanded and bent inwards, thickened on its outer edge, insinuate at the base; sinus deeper than the canal, with a slightly raised rim, the entrance contracted; on the inner lip is a callus sheet, thickening at the posterior angle to a tubercle; canal a mere notch. Length 11 mm., breadth 2·5 mm.

This species has a general resemblance to *Pleuratoma persica* Smith, but that differs by larger size, furrows on the base, and a constricted fasciole.

*Hab.* Queensland:—10 fathoms, Cape Sidmouth (type, A. U. Henn); 4 to 14 fathoms, Albany Passage (self); 20 fathoms, Darnley Island (Brazier).

*CLAVUS COSTATUS* sp. nov.

(Plate xlv., figs 48, 49.)

Shell small, ovate-elongate, solid and compact. Colour dull white, the summit buff-yellow, base anterior to the insertion of the lip pale orange-yellow; along the suture are irregular chocolate splashes. Whorls seven, including a protoconch of two depressed whorls. Sculpture:—There are eight thick and prominent ribs to a whorl; these descend the shell vertically and continuously; on the base they are slightly flexed, and each terminates anteriorly in a bead; both ribs and interstices are engraved by very minute and dense spiral striae; the snout is traversed by a few coarse spirals, which cease at the bead row; on the smooth glossy protoconch is a pronounced median keel, which ends abruptly at the topmost rib. Aperture pyriform, produced into a short, wide, open canal; behind the lip is a prominent varix which, rising above the suture, fills an intervariceal space on the preceding whorl; a substantial callus sheet spreads on the inner lip, and a tubercle is formed near the right insertion; just in front of the canal is a slight insinuation of the outer lip. Length of specimen drawn 6 mm., breadth 3 mm.; another specimen, length 9 mm., breadth 3·5 mm.

*Hab.* Queensland:—12 fathoms, Darnley Island (Brazier).

*CLAVUS CYGNEUS* Melvill and Standen.

*Drillia nitens* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 154 (not *Charatula nitens* Hinds, Zool. Sulphur, ii., 1844, p. 20, pl. vi., fig. 17).

*Drillia cygnea* Melvill and Standen, Journ. of Conch., viii., 1897, p. 379, pl. xi., fig. 82. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 137.

*Hab.* Queensland:—25 to 30 fathoms, Darnley Island; 11 fathoms, Palm Island (Brazier); 5 to 10 fathoms, Hope Island (self).

CLAVUS EXASPERATUS *Reeve*.

(Plate xlv., fig. 50.)

*Pleurotoma exasperata* Reeve, Proc. Zool. Soc., 1843, p. 32. *Id.* Reeve, Conch. Icon., i., 1843, pl. ii., fig. 8. *Id.* Weinkauff, Conch. Cab., 1876, p. 54, pl. xii., figs. 1, 3. *Id.* von Martens, Fauna Mauritius, 1880, p. 226.

*Drillia exasperata* Smith, Fauna Maldive, Laccadive, ii., 1903, p. 603.

*Drillia auriculifera* var. *exasperata* Bouge and Dantzenberg, Journ. de Conch., xli., 1913, p. 136.

*Pleurotoma exigua* Hombron and Jacquinot, Voy. Pole Sud., iv., Zool., 1853, p. 111., pl. xxv., figs. 21, 22 (not *P. exigua* C. B. Adams, Panama Shells, 1852, p. 142).

*Drillia lirida* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 453.

*Hab.* Queensland:—Torres Straits (type of *exigua*, Hombron and Jacquinot); 5 to 10 fathoms, Hope Islands (self). Northern Territory:—Darwin.

CLAVUS UNDATUS *Hedley*.

*Aspella undata* Hedley, Rec. Austr. Mus., vi., 1907, p. 294, pl. lv., fig. 15.

*Hab.* N. S. Wales:—80 fathoms, Narrabeen (type); 100 fathoms, Wollongong (self).

CLAVUS VIDUUS *Reeve*, var. *VIDUALOIDES* *Garrett*.

(Plate xlv., fig. 51.)

*Drillia vidualoides* Garrett, Proc. Acad. Sci. Philad., 1873, p. 217, pl. ii., fig. 28. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 397. *Id.* Bouge and Dantzenberg, Journ. de Conch., lxi., 1914, p. 143.

*Hab.* Queensland:—Murray Island, Lizard Island, and Hope Island beaches (self).

IREDALEA *Oliver*.

*Iredalea* Oliver, Trans. N.Z. Inst., xlvii., 1914 (1915), p. 538, type *I. subtropicalis* Oliver.

*Zafra* H. Adams, Proc. Zool. Soc., 1872, p. 14, and subsequent authors, but not *Zafra* A. Adams, Ann. Mag. Nat. Hist. (3), vi., 1860, p. 331.

The name of *Zafra* was in 1872 transposed by Henry Adams to a turrid species incompatible with the columbelloid type for which the genus had been erected twelve years earlier. May it be that our Turridæ is a polymorphic assemblage in which some pyrenoid elements have been unnaturally included? It is noteworthy how persistently authors have grouped the smaller Pyrenidæ with Turridæ. Chenu referred *Macteola segesta* to *Columbella*, Petterd referred *Mitriothora alba* to *Columbella*, Hinds

referred *Anarithma metula* to *Clavatula*, Pease referred *Seminella varia* to *Cythara*, and von Martens referred *Columbella marquessa* to *Daphnella*. Dall noted that *Saracothoria*, though referred to the Pleurotomidae, is obviously an *Anachis*. Tate remarked that the Tasmanian fossil *Mangilia gracilirata* belongs to *Columbella*. The species of *Iredalea* have been distributed through several genera. Their very solid but narrow shell is sculptured by numerous slender and continuous riblets; a brown band on the periphery is a usual feature.

Besides those species here recorded as Australian I suggest the inclusion in this genus of the following exotic forms:—*Pleurotoma acuminata* Mighels, *Drillia minutissima* Garrett, *D. pygmaea* Dunker, *D. themeropsis* Melvill and Standen, *D. scathoporphyria* Melvill and Standen, *Mangilia thalysa* Melvill and Standen, and *M. theoteles* Melvill and Standen.

#### IREDALEA MACLEAYI Brazier.

*Clathurella macleayi* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 157.

*Id.* Hedley, Rec. Austr. Mus., iv., 1901, p. 122, pl. xvi., fig. 2.

*Hab.* Queensland:—25 to 30 fathoms, Daruley Island; 13 fathoms, Princess Charlotte Bay; 20 fathoms, Cape Grenville; 11 fathoms, Cape York (Brazier); 11 fathoms, Cape Sidmouth (Henn); 7 to 10 fathoms, Port Curtis; 15 fathoms, Palm Island; 5 to 10 fathoms, Hope Island; 4 to 14 fathoms, Albany Passage (self).

#### IREDALEA PUPOIDEA H. Adams.

*Zafra pupoidea* H. Adams, Proc. Zool. Soc., 1872, p. 14, pl. iii., fig. 27.

*Pleurotoma pupoidea* Melvill and Standen, Journ. of Conch., vii., 1895, p. 14.

*Drillia pupoidea* Bonge and Dantzenberg, Journ. de Conch., lxi., 1914, p. 134.

*Mangilia victor* Sowerby, Proc. Malac. Soc., i., 1894, p. 45, pl. iv., fig. 9.

*Hab.* Queensland:—Beach, Murray Island (self).

#### IREDALEA SUBTROPICALIS Oliver.

(Plate xlv., fig. 52.)

*Iredalea subtropicalis* Oliver, Trans. N.Z. Inst., xlvii., 1914 (1915), p. 538, pl. ix., fig. 34.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self); Barrier Reef, off Cairns (D. Pitt).

#### SCRINIUM *gen. nov.*

Shell small, oblong, rounded at each end. Whorls few. Protoconch low, dome-shaped. Colour yellow and brown, uniform or variegated. No differentiation of fasciole area. Sculpture of obscure radial ribs and faint spiral grooves. Aperture rather wide, smooth within, the sinus shallow, lip simple, canal short and wide, with an everted margin; columella concave and twisted. Type *Mitromorpha brazieri* Smith.

Confusion was introduced into this section of conchology when E. A. Smith first referred an Australian species to *Mitromorpha*.<sup>49</sup> Iredale recently drew attention<sup>50</sup> to the accumulation of errors which has enveloped *Mitromorpha*. It seems likely that "*Mitromorpha*," as typified by *M. gibosa*, does not even belong to the turrid group. A survey of those Australian species which have been associated with that genus leads me to conclude that *Mitromorpha* does not occur in Australia. For them the following re-arrangement is now proposed.

*Mitromorpha brazieri* Smith, for which *Scrinium* is now suggested, *Bathytoma sarciacula* Hedley, and *B. biconicum* Hedley, are re-classified under the generic name of *Telenchilus*.

*Mitromorpha cassandra* Hedley, *M. pallidula* Hedley, and *M. solida* May, are now transferred to *Prosipha* Thiele.

*Columbella alba* Petterd, *Mangilia incerta* Pritchard and Gatliff, *Mitra daphnelloides* Tenison Woods, *Mitromorpha angusta* Verco, *M. arcostata* Verco, *M. costata* May, *M. multicostata* May, *M. parvicostata* Verco, and *M. paula* Verco, are now all assembled in a new genus *Mitriothara*.

To *Scrinium* I would also refer *Bela neozelanica* Suter,<sup>51</sup> from North New Zealand.

#### SCRINIUM BRAZIERI Smith.

*Mitromorpha brazieri* Smith, Proc. Zool. Soc., 1891, p. 487, pl. xl., fig. 2.

*Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31.

*Apaturris brazieri* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, p. M 80.

*Hub.* N.S.Wales:—8 fathoms, Watsons Bay (type, Brazier). South Australia:—St. Vincent Gulf (Sowerby).

#### SCRINIUM FERTIVUM *sp. nov.*

(Plate xlv., fig. 53.)

Shell small, very solid, ovate-oblong, rounded at either end. Whorls six, two forming the low protoconch, convex, a little constricted below the suture, which is deeply impressed. Colour vinaceous-buff, sometimes with a white zone its own breadth below the suture, and half-a-dozen evenly spaced narrow white lines on the remainder of the whorl; the columella terra-cotta, and the throat orange-cinnamon with a buff zone. Sculpture:—In general the shell is smooth; on the upper whorls about ten low nodular ribs are scarcely distinguishable; lines of growth are marked by numerous irregular scratches; a few evanescent spiral grooves may or may not appear on the body whorl. Aperture wide, smooth within, outer lip simple, the sinus represented by an arch of the summit; inner lip a thin callus, which at the basal axis meets at an acute angle a thicker callus rising to form a reflected border to the short and very broad canal; columella vertical, flattened, and a little twisted. Length 7.5 mm., breadth 3 mm.

<sup>49</sup> Smith—Proc. Zool. Soc., 1891, p. 487, pl. xl., fig. 2.

<sup>50</sup> Iredale—Proc. Malac. Soc., xii., 1917, p. 328.

<sup>51</sup> Suter—Proc. Malac. Soc., viii., 1908, p. 185, pl. vii., fig. 17.

*Hab.* N. S. Wales:—80 fathoms, 22 miles off Narrabeen (self).  
Victoria:—80 fathoms, Gabo Island (type, "Endeavour").

SCRINIUM GATLIFFI Vereo.

*Drillia gatliffi* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 312, pl. xxviii., fig. 9.

*Mangilia gatliffi* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxxiii., 1910, p. 89.

*Hab.* South Australia:—17 fathoms, Backstairs Passage (type);  
15 fathoms, St. Francis Island; 55 fathoms, Cape Borda (Vereo).  
Victoria:—8 fathoms, Inverloch (Baker).

SCRINIUM IMPENDENS Vereo.

*Mangilia impendens* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 313, pl. xxvii., fig. 3.

*Hab.* South Australia:—St. Vincent Gulf (type); 14 fathoms, Ardrossan; 24 fathoms, Newland Head (Vereo).

Sub-family MANGILIINÆ.

EUCITHARA Fischer.

*Mangilia* Hinds, Proc. Zool. Soc., 1843, p. 45, and Reeve, Conch. Icon., iii., 1846 (not *Mangilia* Risso, 1826).

*Cythara* Adams, Genera Rec. Moll., i., 1853, p. 98, and of most subsequent writers (not *Cythara* Schumacher, 1817).

*Eucithara* Fischer, Man. Conch., 1883, p. 593, type *Mangilia stromboides* Reeve, Conch. Icon., iii., 1846, pl. v., fig. 33.

Because *Cythara* was by Klein applied in 1753 to the genus now known as *Harpa*, Dr. Paul Fischer rejected *Cythara*, of Schumacher, for a Turrid genus, and substituted *Eucithara*. It was properly answered by Dr. Dall<sup>52</sup> that Klein, being a pre-linnean writer, cannot contend against Schumacher's orthodox nomenclature. But though Fischer's argument fails, his verdict does not: for Schumacher's *Cythara* was not a Turrid. His genotype is a species figured by Chemnitz,<sup>53</sup> which Bolten in 1798 called *Pterygia subterranea*, which Schumacher himself renamed *Cythara striata* in 1817, and which Lamarck in 1822 named *Cancellaria citharella*. As long ago as 1847 Gray<sup>54</sup> agreed to exclude it from the Turridæ. Dr. Pfeiffer<sup>55</sup> identified the Chemnitzian figure as *Strombus plicatus*, a conclusion endorsed by Deshayes.<sup>56</sup> By Sowerby<sup>57</sup> this was regarded as

<sup>52</sup> Dall—Bull. Mus. Comp. Zool., xviii., 1889, p. 100.

<sup>53</sup> Chemnitz—Conch. Cab., iv., 1780, pl. cxlii., fig. 1330.

<sup>54</sup> Gray—Proc. Zool. Soc., 1847, p. 135.

<sup>55</sup> Pfeiffer—Krit. Reg. Conch. Cab., 1840, p. 38.

<sup>56</sup> Deshayes—An. s. vert., ix., 1843, p. 407.

<sup>57</sup> Sowerby—Conch. Illustr. Cancellaria, 1841, p. 8.

an *Oniscia*. The colour markings and the spiral grooves on the anterior part of the shell of Chemnitz favour the reference of *Cythara* to *Strombus* rather than, as by Smith,<sup>58</sup> to *Mangelia lyra* Reeve, or *M. funiculata* Reeve. Even if it be granted that Schumacher's *Cythara* is really a Turrid, it is a species unknown to modern conchology, and the genus has no substantial basis. Tryon<sup>59</sup> has stated that *Otocheilus* is "*Cythara*," in which case it would take precedence of the name here employed, but Dall<sup>60</sup> regards it as absolutely synonymous with *Lyria*. The genus *Conopleura* Hinds (type *C. striata* Hinds, 1844), is probably a deepwater representative of *Eucithara*.

The genus *Eucithara* seems to be a constant associate of reef corals. Typically it is a rather solid turritid-fusiform shell, sculptured by bold longitudinal ribs, over-run by dense spiral threads, and decussated by an even finer radial striation. The aperture is as long, or longer, than the spire, fortified externally by a stout varix which ascends the previous whorl, includes a semi-circular sinus, and extends a free edge over the mouth. Within the lip are a series of short entering ridges, and the columella bears a corresponding series of deeply entering horizontal bars.

Corrections here offered of the "Chevert" records are as follows:—*Mangelia ponderosa* of Brazier (not Reeve) is here regarded as *E. guntheri* Sowerby; his *M. goodalli* is *E. cylindrica*; his *balteata* is *coronata*; his *maculata* is *alacris*; and his *pessulata* is *celebensis*.

#### EUCITHARA ABYSSICOLA Reeve.

*Mangelia abyssicola* Reeve, Conch. Icon., iii., 1846, pl. v., fig. 30. *Id.* Proc. Zool. Soc., 1846, p. 62.

*Cythara abyssicola* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 160.

*Mangelia vittata* Reeve, Conch. Icon., iii., 1846, pl. viii., fig. 53, pl. viii., fig. 65.

*Cythara vittata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 161.

*Mangelia (Cythara) vittata* Odhner, Kung. Sv. Vet. Akademiens Handlingar, lii., 16, 1917, p. 58, pl. ii., fig. 62 (not *Mangelia vittata* Hinds, Zool. "Sulphur," 1844, p. 26, pl. ix., fig. 3; nor *M. vittata* Reeve, Conch. Icon., iii., pl. ii., fig. 14=*M. obesa* Reeve).

*Pleurotoma (Cythara) biclathrata* Sowerbie, Journ. de Conch., xx., 1872, p. 363, and xxi., 1873, p. 59, pl. iv., fig. 4. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 157.

*Pleurotoma (Glyphostoma) exquisita* Smith, Ann. Mag. Nat. Hist. (5), x., 1882, p. 305.

*Raphitoma exquisita* Boettger, Nachr. Mal. Gesell., xxvii., 1895, p. 63.

<sup>58</sup> Smith—Journ. Linn. Soc. Zool., xii., 1876, p. 538.

<sup>59</sup> Tryon—Man. Conch., vi., 1884, p. 362.

<sup>60</sup> Dall—Trans. Wagn. Inst., iii., 1890, p. 85.

*Hab.* Queensland:—10 to 20 fathoms, Darnley Island; Warrior Island (Brazier); 4 to 14 fathoms, Albany Passage; 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Islands (self). Western Australia:—12 fathoms, 45 miles W.S.W. Cape Jaubert (Mjöberg).

EUCITHARA ALACRIS *sp. nov.*

(Plate xlv., figs. 54, 55.)

*Cythara maculata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 160 (not *Mangelia maculata* Reeve).

Shell slender, fusiform, glossy. Whorls seven, of which one and a half compose a small, smooth, helicoid protoconch. Colour white, ornamented with four to six pale orange bands, appearing only in the interstices, not on the ribs; these sometimes coalesce from above and below, thus replacing spiral by radial painting. Sculpture:—Radial ribs are well developed, projecting as an angle on the shoulder, continuing from suture to base, and amounting to ten on the last whorl; the spiral threads are sharp on the upper whorls, where they are decussated by radial striae; gradually they vanish, till on the middle of the last whorl the surface seems smooth to the eye, and only a few engraved spirals can be found with a lens. Aperture:—The mouth is linear; the slight varix encloses a small sinus, and extends in a narrow free edge; inner lip well developed, with fifteen cross-bars; beneath the varix are fourteen short entering plicæ. Length 11 mm., breadth 4 mm.

This species is allied to *E. angela*, but is smaller, more pointed at the ends, with fewer ribs, and not so sharply angled at the shoulder.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type); Lizard Island; Bar of Annam River; Dunk and Palm Islands (self); 30 fathoms, Darnley Island (Brazier).

EUCITHARA ANGELA *Adams and Angus.*

*Cithara angela* Adams and Angus, Proc. Zool. Soc., 1863 (1864), p. 419, pl. xxxvii., fig. 4.

*Cithara balansai* Crosse, Journ. de Conch., xxi., 1873, pp. 65, 131, pl. v., fig. 5.

*Mangilia (Cithara) balansai* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 157.

Of three specimens which I collected in Torres Straits in 1907 one has eight and another fourteen ribs, thus easily linking *angela* with *balansai*, and supporting the above novel synonymy.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).



EUCITHARA ANGULATA *Reeve*.

*Mangelia angulata* Reeve, Conch. Icon., iii., June 1846, pl. viii., fig. 62.  
*Id.* Reeve, Proc. Zool. Soc., August 1846, p. 64. *Id.* Tryon, Man.  
 Conch., vi., 1884, p. 266, pl. xxiv., fig. 28. *Id.* Boettger, Nachr.  
 Malak. Gesell., xxviii., 1895, p. 13.

*Cyathara angulata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 160.

The shell thus labelled in the "Chevert" collection does not agree with Reeve's figure.

*Hab.* Queensland:—5 fathoms, Cape York (Brazier).

EUCITHARA ARENIVAGA *sp. nov.*

(Plate xlv., figs. 56, 57.)

Shell solid, biconical, slightly constricted around the upper part of each whorl. Whorls nine. Colour lavender-gray, with a broad peripheral band of buff descending the spire, and on the last whorl underlined by a single or double chocolate line; lip buff; interior ochraceous brown. Protoconch of two small helicoid whorls. Sculpture:—The first whorl is keeled, and develops small radial ribs; on subsequent whorls the ribs amount to about ten, not continuous from one whorl to the next, bent, and thickened on the shoulder, thence quickly tapering to the suture, continuing in the opposite direction to the base of the last whorl; the whole shell is over-run by microscopic spiral threads, alternately larger and smaller. Aperture:—The mouth is narrow, oblong, protected by a stout varix which ascends the previous whorl, and in which is excavated a shallow semicircular sinus; the lip has a very narrow free margin, within which are about eight small inconspicuous teeth; the columella is overlaid by a thick callus sheet with a definite margin, across it extend ten plications; canal a mere notch. Length 12 mm., breadth 4·5 mm.

This is related to the New Caledonian *E. questieri*, but differs in colour, the general tone being slate, not brown; in being more slender, and having the ribs further apart. There is a general resemblance to *E. reticulata*, but *E. arenivaga* is smaller, with fewer and more widely spaced ribs. Both extremities of *arenivaga* taper more, and the body whorl is proportionately smaller.

*Hab.* Queensland:—Cape Flattery (type), several specimens crawling in pools and over wet sand north of the headland; bar of Annam River (self); Cape York (Brazier).

EUCITHARA BASEDOWI *Hedley*.

*Eucithara basedowi* Hedley, Trans. Roy. Geogr. Soc. S.A., xviii., 1918, p. 279, pl. xli., fig. 4.

*Hab.* Western Australia:—Buccaneer Archipelago (type, Dr. H. Basedow).

EUCITHARA BICOLOR *Reeve*.

*Mangelia bicolor* Reeve, Conch. Icon., iii., June 1846, pl. v., fig. 31. *Id.* Proc. Zool. Soc., August 1846, p. 62. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 147.

*Cythara bicolor* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 161. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 46.

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier).

EUCITHARA BROCHA *sp. nov.*

(Plate xlv., fig. 58.)

Shell solid, biconical. Whorls six, rounded. Colour cinnamon, with several narrow zones of buff; aperture pale buff; interior ochraceous-orange. Sculpture:—Ribs slender, flexuous, fifteen to a whorl, spaced by more than their breadth, alternating from whorl to whorl, not rising above the suture, but extending thence to the base; the inter-costal spaces are crossed by fine engraved striæ. Aperture:—Mouth linear, fortified by a thick broad varix, both sides beset with stout external denticles—ten on the left, nine on the right side. Length 10 mm., breadth 4·5 mm.

*Hab.* Queensland:—Thursday Island (self).

EUCITHARA CALEDONICA *Smith*.

(Plate xlv., figs. 59, 60.)

*Mangelia caledonica* Smith, Ann. Mag. Nat. Hist., (5), x., 1882, p. 217.

*Mangelia zonata* var. *caledonica* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 170.

This species, though united to *E. cithara* Gould by Melvill and Standen, and to *E. zonata* Reeve by Bouge and Dautzenberg, seems to be well differentiated by stout build, pure white colour, fine and even revolving threads, and especially by having only six ribs, including the varix, on the last whorl. It is unrecorded for Australia. To aid its identification I add a drawing of a specimen 10 mm. long collected at Oubatche, New Caledonia, by myself.

*Hab.* Queensland:—Palm Island (self).

EUCITHARA CAPILLACEA *Reeve*.

*Mangelia capillacea* Reeve, Proc. Zool. Soc., 1846, p. 60, and Conch. Icon., iii., 1846, pl. ii., fig. 10.

*Cythara capillacea* Smith, Journ. Linn. Soc. Zool., xii., 1876, p. 538. *Id.* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159. *Id.* Cooke, Ann. Mag. Nat. Hist., (5), xvi., 1885, p. 36. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, pp. 18, 43. *Id.* Hervier, Journ. de Conch., xlv., 1895, p. 182. *Id.* Sturany, "Pola" Exped., Bd. xxiii., 1903, p. 250.

A specimen which I collected in Torres Straits attains a length of 14 mm.

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier); 5 to 8 fathoms, Murray Island; 5 to 10 fathoms, Hope Island (self).

*EUCITHARA CAPILLATA* *Hervier*.

*Cithara capillata* Hervier, Journ. de Conch., xlv., 1895, pp. 54, 181, pl. viii., fig. 2.

*Mangilia capillata* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 158.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island; 4 to 14 fathoms, Albany Passage; 5 to 10 fathoms, Hope Island (self).

*EUCITHARA CELEBENSIS* *Hinds*.

*Mangilia celebensis* Hinds, Proc. Zool. Soc., 1843, p. 46, and Zool. Sulphur, 1844, p. 26, pl. ix., fig. 5. *Id.* Reeve, Conch. Icon., iii., 1846, pl. vii., fig. 49.

*Mangilia psalterium* Melvill and Standen, Journ. of Conch., viii., 1896, p. 285, pl. ix., fig. 23. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 168.

*Cithara eupœila* Hervier, Journ. de Conch., xlv., 1897, pp. 52, 175, pl. vii., fig. 7.

*Cythara optabilis* Sowerby, Proc. Malac. Soc., vii., 1907, p. 300, pl. xxv., fig. 4.

*Cythara pessulata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159 (not *Mangilia pessulata* Reeve).

Mr. T. Iredale writes to me that the type of *M. celebensis* in the British Museum exactly corresponds to co-types of *M. psalterium*. This species of Hinds seems to have been ignored since its discovery.

*Hab.* Queensland:—Bet Island (Brazier); Lizard Island (self); Two Isles, off Cape Flattery (self).

*EUCITHARA CONOHELICOIDES* *Reeve*.

*Mangilia conohelicoides* Reeve, Conch. Icon., iii., 1846, pl. iv., fig. 25. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 41. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 398. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 158.

*Pleurotoma (Cithara) ouager* Souverbie, Journ. de Conch., xxiii., 1875, p. 286, pl. xiii., fig. 4.

*Hab.* Queensland:—Murray Island and Rocky Isle, off Cape Flattery (self).

EUCITHARA CORONATA *Hinds*.

*Mangelia coronata* Hinds, Proc. Zool. Soc., 1843, p. 45. *Id.* Zool. "Sulphur," 1844, p. 26, pl. ix., fig. 2. *Id.* Reeve, Conch. Icon., iii., 1846, pl. vii., fig. 51.

*Mangelia zonata* Reeve, Conch. Icon., iii., 1846, pl. iii., fig. 15. *Id.* Smith, Journ. Linn. Soc. Zool., xii., 1876, p. 538. *Id.* Boettger, Nachr. Mal. Gesell., xxvii., 1895, p. 42. *Id.* Hervier, Journ. de Conch., xlv., 1897, p. 180. *Id.* Bouge and Dantzenberg, Journ. de Conch., lxi., 1913, p. 167.

*Cythara balteata* Brazier (not Reeve), Proc. Linn. Soc. N.S.W., i., 1876, p. 160.

*Mangelia (Cythara) chiomea* Melvill and Standen, Journ. Linn. Soc. Zool., xxvi., 1899, p. 156, pl. x., fig. 4.

By the kind assistance of Mr. H. Fulton I have been able to recognise this widely distributed, but generally neglected, species. Both in size and colour it varies a good deal. The arched summits of the ribs rising above the line of the suture is a characteristic feature.

*Hab.* Queensland:—Murray Island (type of *chiomea*, Haddon); Thursday Island (Henn); Darnley, Barnard, and Eclipse Islands (Brazier); Lizard, Dunk, Rocky Isle, and Two Isles, off Cape Flattery, Palm Island (self).

EUCITHARA CYLINDRICA *Reeve*.

*Mangelia cylindrica* Reeve, Conch. Icon., iii., 1846, pl. ii., fig. 9.

*Cythara cylindrica* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, pp. 18, 43. *Id.* Hidalgo, Revista Acad. Madrid, i., 1904, p. 338.

*Cythara goodalli* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 160 (not of Reeve).

The shells collected by the "Chevert" expedition and determined by Mr. Brazier as *cylindrica* are another species, but *cylindrica* is represented in that collection by specimens labelled *Mangelia goodalli*, and by unnamed specimens from Darnley Island, Cape Grenville, and Katow. Australian shells differ from the figure of Reeve by fewer and coarser radials, absence of subsutural colour markings, and rather broader build. In these respects they approach, but do not coincide with, a series from Singapore determined as *cylindrica*, and kindly sent to me by Mr. J. R. Le B. Tomlin.

*Hab.* Queensland:—Cape Grenville; 20 fathoms, Darnley Island (Brazier); 11 fathoms, Cape Sidmouth (Henn); Forsyth Island, Gulf of Carpentaria; 4 to 14 fathoms, Albany Passage; 15 fathoms, Palm Islands (self).

EUCITHARA EUMERISTA *Melville and Standen*.

*Mangelia eumerista* Melville and Standen, Journ. of Conch., viii., 1896, p. 280, pl. ix., fig. 15. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 160.

*Mangelia signum* Melville and Standen, *op. cit.*, p. 286, pl. ix., fig. 24.

Four specimens of the variety *signum* represent this species, which is hitherto unrecorded from Australia.

*Hab.* Queensland:—Beach, Lizard Island (self).

EUCITHARA GIBBOSA *Reeve*.

*Mangelia gibbosa* Reeve, Conch. Icon., iii., May 1846, pl. iii., fig. 21, and Proc. Zool. Soc., July 1846, p. 61. *Id.* Tryon, Man. Conch., vi., 1884, p. 266, pl. xxiv., fig. 25. *Id.* Melville and Standen, Journ. of Conch., viii., 1897, p. 399. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 161. *Id.* Hidalgo, Revista Acad. Madrid, i., 1904, p. 338.

*Cithara gibbosa* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 45.

*Mangelia novae-hollandiae* Reeve, Conch. Icon., iii., May 1846, pl. iv., fig. 27. *Id.* Proc. Zool. Soc., 1846, p. 62.

*Cithara novae-hollandiae* Shirley, Proc. Roy. Soc. Queensland, xxiv., 1913, p. 55.

*Hab.* Western Australia:—Swan River, type of *novae-hollandiae*, (Reeve). Queensland:—Cape York (Shirley).

EUCITHARA GRACILIS *Reeve*.

*Mangelia gracilis* Reeve, Conch. Icon., iii., 1846, pl. ii., fig. 11, and Proc. Zool. Soc., 1846, p. 60. *Id.* Cooke, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 36. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 43. *Id.* Hervier, Journ. de Conch., xlv., 1897, p. 179. *Id.* Melville and Standen, Journ. of Conch., viii., 1897, p. 399. *Id.* Melville and Standen, Journ. Linn. Soc., Zool., xxvii., 1899, p. 156. *Id.* Conturrier, Journ. de Conch., lv., 1907, p. 131. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 161.

*Hab.* Queensland:—Warrior Island (Haddon).

EUCITHARA GUENTHERI *Sowerby*.

(Plate xlv., fig. 61.)

*Mangelia ponderosa* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159 (not Reeve).

*Cythara guentheri* Sowerby, Proc. Zool. Soc., 1893, pl. xxxviii., figs. 27, 28.

My figure is derived from a specimen 20 mm. long and 8 mm. broad, dredged by Brazier off Cape Grenville.

The species is like a gigantic *E. abyssicola*. It is more gibbous, with fewer radials, and larger than *E. lyrica*.

*Hab.* Western Australia.—38 fathoms, Holothuria Banks (type, J. J. Walker). Queensland:—10 fathoms, Darnley Island; Cape Grenville (Brazier); 4 to 14 fathoms, Albany Passage; 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Island (self).

#### EUCITHARA INFULATA Hedley.

*Mangelia infulata* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 457, pl. xliv., fig. 92.

This species closely resembles *E. apollinea* Melvill, from the Persian Gulf, but may be distinguished by larger size, fewer ribs, and more pronounced spiral striae. For a group of smooth shells having the contour of *Eucithara*, but without the characteristic grain sculpture, I now propose a subgenus *Leiocithara*, type *M. infulata*. The following species may also be included:—*M. pellucida* Reeve, *M. trivittata* Adams and Reeve, *M. apollinea* Melvill.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 15 fathoms, Palm Island; 5 to 8 fathoms, Murray Island (self).

#### EUCITHARA LYRA Reeve.

(Plate xlv., fig. 62.)

*Mangelia lyra* Reeve, Conch. Icon., iii., 1846, pl. i., fig. 3.

*Cythara citharella* Smith, Journ. Linn. Soc. Zool., xii., 1876, p. 538.

*Cithara lyra* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 436.

As this species is involved in some obscurity I present the figure of a shell thus identified, 15 mm. in length, which I collected dead on the beach at the mouth of the Annam River, Queensland. It is named by comparison with a Philippine shell sent to me by Mr. H. Falton. The figure of Reeve represents a shell which, though slightly larger, is still immature and toothless. *E. lyra* seems not to have been previously recorded from Australia.

*Hab.* Queensland.—Annam River bar (self); Barney Point; Gladstone (Kesteven).

#### EUCITHARA LYRICA Reeve.

*Mangelia lyrica* Reeve, Conch. Icon., iii., 1846, pl. iii., fig. 20, and Proc. Zool. Soc., 1846, p. 61. *Id.* Hidalgo, Revista Acad. Madrid, i., 1904, p. 338.

*Cithara lyrice* Shepman, Siboga Exped. Monogr., xlix., 1913, p. 435.  
*Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 181, pl. x., fig. 3.

*Cythara cylindrica* var. *lyrica* Smith, Zool. Coll. "Alert," 1884, p. 41,  
 pl. iv., fig. 11.

*Hab.* Queensland:—7 fathoms, Port Curtis (Coppinger).

*EUCITHARA MONOCHORIA* *sp. nov.*

(Plate xlv., fig. 63.)

Shell small, stout, solid, biconical. Colour russet-brown, with a definite buff band on the shoulder covering three spirals, and a less definite buff band on the base; penultimate, antepenultimate whorls, and varix also buff. Whorls six and a half, of which two and a half compose the sharply differentiated protoconch. Sculpture:—The earlier whorls of the protoconch are smooth, and the last has about twenty delicate radial riblets; the ribs on the adult shell are broad, prominent, perpendicular, and discontinuous, at first eleven, at last nine; both ribs and interstices are traversed by flat-topped elevated spirals, spaced more than their breadth apart, on the last whorl twenty-five, on the penultimate eight; the spirals are grained by the passage of fine radial striæ. Aperture:—A substantial varix stretches a free limb over the mouth; beneath it are six small tubercles; on the inner lip are ten entering plaits. Length 5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type, self).

*EUCITHARA MORARIA* *sp. nov.*

(Plate xlv., fig. 64.)

Shell small and subcylindrical. Colour blackish brown, the apex and bands on the lip buff. Whorls seven, the upper short, well rounded, the last flatter, half the length of the shell. Sculpture:—Riblets are set at the rate of about eighteen to a whorl, more than the breadth of each apart, incurved at the suture, those above more prominent, on the last whorl decreasing in height, and gradually vanishing on the base; both riblets and inter-costal spaces are closely encircled by alternately larger and smaller threads, which are in turn grained by finer radial lines. Aperture narrow; well developed external varix, slightly incised by posterior notch; within the outer lip are a few small denticles, and on the inner lip fourteen short entering ridges. Length 9 mm., breadth 3.5 mm.

This species is a relation of *E. cylindrica*, from which it is distinguished by dentition, colour, coarser sculpture, and blunter extremities.

*Hab.* Queensland:—Annam River bar (type, self); 13 fathoms, Princess Charlotte Bay (Brazier).

EUCITHARA MIRIAMICA<sup>61</sup> *sp. nov.*

(Plate xlvii., fig. 65.)

Shell small, solid, cylindro-conic. Colour ferruginous, with an ochraceous orange band on the shoulder; another specimen is uniform orange, except the varix, which is ferruginous. Whorls seven, including a protoconch of two and a half whorls. Sculpture:—Protoconch at first smooth, afterwards ornamented by numerous fine arcuate riblets, which end abruptly; the adult whorls carry from eight to nine prominent spaced ribs: these are crossed by distant spiral threads, of which there are twenty on the last whorl, and six on the penultimate; the whole is over-run by fine radial lines of minute grains. Aperture protected by a strong varix, in which a semi-circular sinus is excavated; on each side of the sinus is a tubercle, and but a single plait on the upper part of the columella. Length 4.5 mm., breadth 2 mm.

In size and sculpture this has much resemblance to *E. monochoria*, but may be distinguished by more slender form and absence of columella armature.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self); 20 fathoms, off Endeavour Reef (A. R. McCulloch).

EUCITHARA PAGODA *May*.

*Daphnella pagoda* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 393, pl. xv., fig. 20.

*Hab.* Tasmania:—80 fathoms, 10 miles east of Schouten Island (type, May).

EUCITHARA PELLUCIDA *Reeve*.

*Mangelia pellucida* Reeve, Proc. Zool. Soc., 1846, p. 64. *Id.* Reeve, Conch. Icon., iii., 1846, pl. viii., fig. 61.

*Cythara pellucida* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 160.

*Hab.* Queensland:—25 to 30 fathoms, Darnley Island (Brazier); Lizard Island; 5 to 8 fathoms, Murray Island (self).

EUCITHARA PHYLLIDIS *sp. nov.*

(Plate xlvii., figs. 66, 67.)

Shell small, solid, fusiform, angled at the shoulder, contracted at the sutures and at the base. Colour crystalline white, with or without a dorsal blot and zone of ochraceous-orange only on the last whorl. Whorls seven, including a smooth helicoid tip. Sculpture:—The radials are wide spaced, prominent, flexuous, perpendicular, and continuous ribs, which diminish at the shoulder and gradually vanish on the base; on the antepenultimate there are ten, and on the last whorl eight, including the

<sup>61</sup> The name of the Murray Island people is "Miriam."



varix; the spirals are extremely fine and close threads, evenly distributed over the whole surface, and microscopically beaded. Aperture:—The mouth is vertical, and rather wide; from the varix a thin lip projects, curving forwards at the periphery, and followed beneath by an insinuation; underneath the varix the throat is finely striated; sinus broad and shallow; canal short; on the inner lip a small tubercle rises opposite the sinus, and the columella is smooth. Length 7.5 mm., breadth 3 mm.

This species also occurs in the Loyalty Islands, for specimens of it from Lifu were given to me under the name of *Cithara striatella* Smith. A different, though related, species has lately been figured<sup>62</sup> under this name. Possibly mine is the species which Bouge and Dautzenberg<sup>63</sup> doubtfully record from Lifu as *Mangelia inepta* Smith.

This dainty little shell is appropriately named after the lady whose drawings embellish this memoir.

*Hab.* Queensland:—Beach, Lizard Island (type, self).

EUCITHARA PULCHELLA *Reeve*.

*Mangelia pulchella* Reeve, Conch. Icon., iii., 1846, pl. iii., fig. 18, and Proc. Zool. Soc. 1846, p. 61. *Id.* Melvill and Standen, Journ. Linn. Soc. Zool., xxvi., 1899, p. 156.

*Cithara pulchella* Hidalgo, Revista Acad. Madrid, 1904, p. 339.

*Hab.* Queensland:—Torres Straits (Haddon).

EUCITHARA SOUVERBIEI *Tryon*.

*Pleurotoma (Cithara) coniformis* Sonverbie, Journ. de Conch., xxiii., 1875, p. 288, pl. xiii., fig. 5 (not *Cythara coniformis* Gray).

*Mangelia souverbiei* Tryon, Man. Conch., vi., 1884, p. 264, pl. xxii., fig. 65. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 399. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 164.

*Cithara souverbiei* Hervier, Journ. de Conch., xlv., 1897 (1898), p. 51.

This species has not been hitherto recorded from Australia. I collected on the beach in 1916 a single specimen of the white variety.

*Hab.* Queensland:—Rocky Isle, off Cape Flattery (self).

EUCITHARA STRIATISSIMA *Sowerby*.

(Plate xlv., fig. 68.)

*Cythara striatissima* Sowerby, Proc. Malac. Soc., vii., 1907, p. 294, pl. xxv., fig. 3.

<sup>62</sup> Melvill—Proc. Malac. Soc. xii., 1917, pl. x., fig. 4.

<sup>63</sup> Bouge and Dautzenberg—Journ. de Conch., lxi., 1913 (1914), p. 162.

A specimen from Torres Straits, thus doubtfully determined from literature and here figured, is immature and small, being 8.5 mm. long and 4 mm. broad, biconical, densely encircled by spiral threads, of which there are about forty on the last whorl. There are about nineteen radials projecting as tubercles along the angle of the shoulder, but faint above and below. On the earlier whorls the shoulder nodules are proportionately more prominent. The whole surface has a secondary sculpture of close microscopic radial threads. Whorls seven, including a small smooth protoconch of two helicoid whorls. Aperture incomplete, but commencing to form a varix and mounting on the preceding whorl. *Cithara matakuaana* Smith<sup>64</sup> has a general resemblance, but has fewer and coarser radials.

*Hab.* Queensland :—5 to 8 fathoms, Murray Island (self); 20 fathoms, off Endeavour Reef (A. R. McCulloch).

*ENCITHARA STROMBOIDES* Reeve.

*Mangelia stromboides* Reeve, Conch. Icon., iii., June 1846, pl. v., fig. 33, and Proc. Zool. Soc., July 1846, p. 63.

*Encithara stromboides* Fischer, Man. de Conch., 1883, p. 593.

*Cithara stromboides* Boettger, Nachr. Malak. Gesell., xxvii., 1895, pp. 18, 44. *Id.* Hidalgo, Revista Acad. Madrid, i., 1904, p. 339. *Id.* Schepman, Siboga Exped. Monogr. xlix., 1913, p. 435.

*Cithara delacouriana* Crosse, Journ. de Conch., 1869, p. 178, and 1872, p. 66, pl. ii., fig. 4. *Id.* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xlv., 1875, p. 90. *Id.* Couturier, Journ. de Conch., lv., 1907, p. 131. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 159.

*Hab.* Queensland :—Eclipse Island (Brazier); Palm and Green Islands (self).

*ENCITHARA VEXILLUM* Reeve.

*Mangelia vexillum* Reeve, Conch. Icon., iii., 1846, pl. i., fig. 2, and Proc. Zool. Soc., 1846, p. 59. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 44. *Id.* Melvill and Standen, Journ. of Conch., viii., 1895, p. 98. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 167.

*Cithara vexillum* Hidalgo, Revista Acad. Madrid, i., 1904, p. 339.

*Hab.* Queensland :—Mapoon, Gulf of Carpentaria (self).

*ETREMA* Hedley.

*Etrema* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M. 79.

Shell elongate-conic, solid. Aperture with a series of entering plications on both lips. Notch subsutural, deeply excavate, open and

<sup>64</sup> Smith—Ann. Mag. Nat. Hist. (5), xiv., 1881, p. 328.

effuse exteriorly. Outer lip strongly inflected. Aperture about a quarter of the total height. Sculpture:—Prominent rounded ribs, suddenly swelling on the periphery, but not extending to either base or suture. The whole shell, except the nucleus, is usually over-run by fine, dense, beaded threads. Colour white, ranging through buff and brown to chocolate, variously disposed, but frequently with a dark patch on the lip at the right insertion, and another near the canal. Fasciole not differentiated by sculpture from the rest of the whorl. Type *Mangilia* (*Glyphostoma*) *alicie* Melvill and Standen, 1895.

This group has been included by most recent writers in *Glyphostoma*, a genus whose history therefore acquires an interest in this connection. Briefly it is sketched thus:

For a West Indian Turrid, *G. dentifera*, having an aperture toothed almost as strongly as that of *Cypræa*, Dr. W. M. Gabb<sup>65</sup> proposed in 1872 a new genus, *Glyphostoma*. Soon afterwards Semper<sup>66</sup> re-grouped under *Glyphostoma* the following tropical Indo-Pacific species:—*M. spurea*, *cinerea*, *candida*, and *argillacea* Hinds; *M. roseotincta* Montrouzier; and *M. obesa* Garrett. An Australian species in the form of *G. paucimaculata* was added by Angus.<sup>67</sup> In the hands of Bouge and Dantzenberg this genus aggregated a considerable number of new New Caledonian species. A revulsion then occurred, and Schepman and Melvill have lately transferred several of these Indo-Pacific *Glyphostoma* to *Lienardia*.

Hervier<sup>68</sup> had already noticed that several species grouping round *G. crassilabrum* Reeve were distinguishable from the body of the genus as he knew it.

Dr. W. H. Dall with his usual kindness gave me, in addition to a characteristic specimen, the benefit of his experience. With reference to *Glyphostoma* he writes:—"It appears to me a good genus. The shell is essentially like the shells Carpenter used to call *Clathurella* (not the genus *Defrancia*), but is larger, and is especially characterised by the denticulate calluses on the pillar lip and outer varix. It has no operculum. The protoconch is sharply carinate, and the shell is invariably more or less axially ribbed and with some spiral sculpture."

Comparing an example of *G. gabbi* Dall with the so-called Australian *Glyphostoma*, I find that in each the protoconch is on the same general plan—a small smooth helicoid tip of a whorl and a half, followed by one or two whorls with a sharp peripheral keel. In the fasciole there is a marked distinction. *Glyphostoma* has the fasciole on the larger whorls traced by discrepant sculpture, but in *Etrema* the fasciole is obliterated in a sculpture uniform with the rest of the shell. In *Etrema* the tubercles of the columella never ascend to the parietal wall. In other features of the aperture there is a general resemblance.

<sup>65</sup> Gabb—Proc. Acad. Nat. Sci. Philad., 1872, p. 270, pl. xi., fig. 4.

<sup>66</sup> Semper—Verh. Ver. Hamburg, ii., 1876, pp. 199-203.

<sup>67</sup> Angus—Proc. Zool. Soc., 1880, p. 416.

<sup>68</sup> Hervier—Journ. de Conch., xliv., 1896, p. 85.

I conclude that the Australian species may be conveniently separated from the West Indian *Glyphostoma*, with which they have been associated. *Etrema* is indeed nearer to *Lienardia*, from which its elongate form and different colour scheme distinguish it.

*ETREMA ACRICULA* *sp. nov.*

(Plate xlv., fig. 69.)

Shell small, solid, ovate-lanceolate, turreted, the prominence of the varix inclining the shell to a hatchet form. Colour buff, apex pale orange; darker orange on the base and aperture. Whorls seven, including the protoconch of three whorls. Sculpture:—Above the sharp shoulder angle run two or three small spiral threads; below it on the last whorl are eleven spiral cords, at first prominent and spaced, but gradually becoming smaller and more crowded on the base and snout; on the last whorl are nine radials descending from the shoulder to the base as prominent perpendicular riblets. Aperture:—The varix is very prominent, folding a free limb towards the aperture, externally it is traversed by six spiral threads, internally there are three tubercles; the sinus is excavated at an oblique angle to the aperture, and is broad and effuse; canal short and open; columella with two longer and one short plait, the latter lowest. Length 3.5 mm., breadth 1 mm.

This species has somewhat the appearance of a miniature and telescoped *Pseudoraphitoma ditigloti*.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ETREMA ALICIE* *Melville and Standen.*

(Plate xlvii., fig. 70.)

*Mangilia (Glyphostoma) alicie* Melville and Standen, Journ. of Conch., viii., 1895, p. 95, pl. ii., fig. 15.

*Glyphostoma alicie* Hedley, Mem. Austr. Mus., iii., 1899, p. 471. *Id.* Bouge and Dautzenberg, Journ. de Conch., xli., 1913 (1914), p. 170.

*Lienardia alicie* Schepman, Siboga Exped. Monogr. xlix., 1913, p. 436.

As stated under the heading of *E. labiosa*, my previous reference to *E. alicie*, from Queensland, and my figure<sup>69</sup> was based on another species. An authentic Lifuan specimen of *E. alicie* is now figured here to dispel further misapprehension.

*Hab.* Queensland:—Lizard Island (self).

*ETREMA ALLITERATA* *Hedley.*

*Glyphostoma alliteratum* Hedley, Proc. Linn. Soc. N.S.W., xxxix., 1915, p. 728, pl. lxxxii., figs. 56, 57.

*Hab.* N.S.Wales:—Port Jackson (type); Wreck Bay; Gerringong; Dudley (self). Queensland:—Caloundra (Kesteven).

<sup>69</sup> Hedley: Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 471, pl. xliii., fig. 88.

ETREMA ALPHONSIANA *Hervier*.

(Plate xlvii., fig. 71.)

*Glyphostoma alphonsonianum* Hervier, Journ. de Conch., xliii., 1895 (1896), p. 237, and xlv., 1896 (1897), p. 86, pl. iii., fig. 24. *Id.* Bouge and Dantzenberg, *op. cit.*, lxi., 1913 (1914), p. 171.

As the original figure is rather indefinite, an illustration is here supplied of a dead specimen that I gathered in July, 1916, on the beach of Lizard Island. It has not yet been noticed from Australia.

*Hab.* Queensland:—Lizard Island; Murray Island (self).

ETREMA ARGILLACEA *Hinds*.

*Clavatula argillacea* Hinds, Proc. Zool. Soc., 1843, p. 39, and Zool. Sulphur, 1844, p. 18, pl. vi., fig. 1.

*Pleurotoma argillacea* Reeve, Conch. Icon., i., 1845, pl. xxv., fig. 217.

*Glyphostoma argillacea* Semper, Verh. Ver. Hamburg, ii., 1876, p. 202.

*Clathurella argillacea* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 156.

*Lienardia argillacea* Jousseaume, Bull. Soc. Zool. France, ix., 1884, p. 185.

*Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 185.

*Hab.* Queensland:—30 fathoms, Darnley Island (Brazier).

ETREMA BICOLOR *Angas*.

*Clathurella bicolor* Angas, Proc. Zool. Soc., 1871, p. 18, pl. i., fig. 20, and 1880, p. 416. *Id.* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 38. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 29. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 179. *Id.* May, Proc. Roy. Soc. Tasm., 1908, p. 53. *Id.* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 308. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 183.

*Glyphostoma bicolor* Hedley, Proc. Linn. Soc. N.S.W., xxxix., 1914 (1915), p. 729, pl. lxxxii., figs. 60, 61.

In general appearance *E. bicolor* is very close to *E. pyramidula*, but seems to be distinguishable by a taller and more slender form, less prominent radials, finer sculpture, and rounder whorls.

*Hab.* N.S. Wales:—Port Jackson (type, Angas); Wreck Bay; Jervis Bay (self). Victoria:—Western Port (Gatliff). Tasmania:—Circular Head (Tenison-Woods); Fredrick Henry Bay (May). South Australia:—5 to 22 fathoms, St. Vincent Gulf; 40 to 110 fathoms, Beachport; 45 fathoms, Neptune Island; Murat Bay; St. Francis Island (Vereo). Western Australia:—Cottesloe (Hemm).

*ETREMA CAPILLATA* *sp. nov.*

(Plate xlvii., fig. 72.)

Shell rather thin and light, biconical, torreted, and sharply angled at the shoulder. Colour buff, with rufous stains on the columella, the lip insertion, and along the suture. Whorls eight, including the protoconch, which has two small smooth whorls, and a third larger depressed and crossed by sharp arched riblets. Sculpture:—The adult whorls carry discontinuous prominent spaced ribs, which arise at the suture and continue to the base, those on the spire being perpendicular and set closer together, at the rate of ten to a whorl, those on the last whorl being wider spaced at eight to a whorl, and flexed forward below the shoulder; these cords gradually become smaller and closer; the whole shell is over-run by very fine and close hair-lines which, decussated by a corresponding spiral sculpture, produces a fine grained surface. Aperture wide, protected by a prominent varix; sinus wide and shallow; canal short and open. Length 9 mm., breadth 3 mm.

*Hab.* Queensland:—8 fathoms, Weary Bay (self).

*ETREMA CATAPASTA* *sp. nov.*

(Plate xlvii., fig. 73.)

Shell small, ovate-lanceolate, with rounded whorls. Colour orange, with a white median zone. Whorls eight, including a protoconch of three whorls, and of the usual pattern. Sculpture:—On the last whorl are twelve spirals, the anterior ones being fine threads on the snout, and the median ones represented by crescentic beads on the riblets; there are four spirals on the penultimate; radials discontinuous and perpendicular, amounting to twelve on the last whorl. A prominent varix extends a free limb towards the aperture; within it are five small tubercles; the pillar lip has two transverse plaits; canal short; sinus broad and effuse. Length 5.5 mm., breadth 2.2 mm.

*E. catapasta* may be briefly described as a miniature of *E. opsimathes* Melvill and Standen,<sup>70</sup> with which it closely corresponds in sculpture and colour, but from which it differs by being a third of the length, having a whorl less, broader form, and more delicate sculpture.

*Hab.* Queensland:—12 fathoms, Torres Straits (type, Brazier); Lady Elliot Island (Miss Lovell); 10 fathoms, Van Diemens Inlet, Gulf of Carpentaria (self). Papua:—Kaiow ("Chevert").

*ETREMA CULMEA* *n. sp.*

(Plate xlvii., figs. 74, 75.)

Shell rather large for the genus, solid, elevated, and tapering. Colour buff, with salmon-orange between the ribs and on the base. Whorls rounded, ten, including a two-whorled protoconch. Sculpture:—Discontinuous radial ribs, which take the form of oblique, broad, widely spaced

<sup>70</sup> Melvill and Standen—Ann. Mag. Nat. Hist., (7), xii., 1903, p. 314, pl. xxii., fig. 19.

undulations, traverse the upper whorls and vanish on the base; on the last whorl these ribs, exclusive of the varix, amount to eight; these are over-ridden by alternately larger and smaller dense spiral threads; on the last whorl, where the intermediates are sometimes double, the major threads amount to twenty-five; all these threads carry very minute sharp and close grains. Aperture:—Varix very heavy and prominent; sinus broad, and expanding outwardly; canal short and open; inner lip with ten entering ridges, which continue in the throat; columella lip with nine elongate tubercles. Length 15 mm., breadth 5.5 mm.

This is like *Pleurotoma crassilabrum* Reeve, but is larger, and the ribs are more widely spaced.

*Hab.* Queensland:—20 fathoms, Darnley Island (type, Brazier).

*ETREMA CURTISIANA* *sp. nov.*

(Plate xlviii., fig. 76.)

Shell narrowly lanceolate, angled on the spire whorls. Colour uniform ochraceous-buff. Whorls nine, including a protoconch of two smooth and one keeled whorl. Sculpture:—The original keel gradually breaks up into radials, which on the fifth whorl appear as prominent, broad, tubercular ribs, set at about nine to the whorl, perpendicular and discontinuous; these decrease in relative size, but increase in number till they amount to twelve on the last whorl, sometimes splitting into riblets on the base; fine spiral threads, amounting to eleven on the penultimate and to about thirty-three on the final whorl, are spaced on the periphery and crowded towards the base and fasciole area. Aperture:—The varix is prominent and expanded, toothed at the oral margin by the spiral sculpture; columella margin armed by four transverse plications; both sinus and canal are short and expanded. Length 9.5 mm., breadth 4 mm.

This is related to *E. spurca* Hinds, differing from that by smoother contour, more delicate sculpture, more numerous evanescent ribs, and more numerous and finer spirals.

*Hab.* Queensland:—7 fathoms, Port Curtis (type, Brazier).

*ETREMA DENSEPLICATA* *Dunker.*

*Drillia denseplicata* Dunker, Mal. Blatt., xviii., 1871, p. 159.

*Pleurotoma denseplicata* Weinkauff, Conch. Cab., iv., Abth. 3, 1876, p. 107, pl. xxiii., figs. 7, 9.

*Clathurella denseplicata* Hedley, Proc. Linn. Soc. N.S.W., xxvii., 1902, p. 17.

*Id.* Pritchard and Gatliff, Proc. Roy. Soc. Viet., xviii., 1906, p. 50.

*Clathurella philomena* Tenison-Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 141. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 371. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Viet., xii., 1900, p. 177. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 307.

*Drillia atkinsoni* Tenison-Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 142 (not *Drillia atkinsoni* Smith, Ann. Mag. Nat. Hist. (4), xix., 1877, p. 495).

*Siphonalia pulchra* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 139, and 1879 (1880), p. 70. *Id.* Petterd, Journ. of Conch., ii., 1879, p. 353.

Types of *denseplicata* are in the Hamburg Museum, of *crassina* and *kymatessa* in the British Museum, of *atkinsoni*, *philomena*, and *pulchra* in the Tasmanian Museum.

*Hab.* Tasmania:—Bass Strait, type of *denseplicata* (Godeffroy Museum). East Tasmania:—Type of *philomena* (Tenison-Woods); Long Bay, type of *atkinsoni* (Atkinson); Chappell Island, type of *pulchra* (Legrand); King Island (Tate). Victoria:—Portland; Western Port (Pritchard and Gatliff). South Australia:—6 to 300 fathoms, Robe to Le Hunte Bay (Verco).

#### Var. *CRASSINA* Angus.

*Clathurella crassina* Angus, Proc. Zool. Soc., 1880, p. 416, pl. xl., fig. 6.  
*Clathurella parvula* Sowerby (not Reeve), Proc. Malac. Soc., ii., 1896, p. 28.

*Hab.* South Australia:—Aldinga Bay (type, Tate); Spencer Gulf and Hardwick Bay (Bednall). Western Australia:—Cottesloe (Henn). Victoria:—Port Fairy (Whan); Shoreham (Gabriel); Port Phillip (Gatliff).

#### Var. *KYMATESSA* Watson.

*Pleurotoma (Drillia) kymatessa* Watson, Chall. Rep. Zool., 1886, xv., p. 309, pl. xxvi., fig. 5.

*Clathurella kymatessa* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 178.

*Hab.* Tasmania:—38 fathoms, East Monocœur Island ("Challenger"). South Australia:—40 fathoms, Cape Borda (self).

#### *ETREMA ELEGANS* sp. nov.

(Plate xlvii., fig. 77.)

Shell small, ovate-lanceolate, turreted on the upper whorls. Colour buff, with chocolate stains on the pillar and canal. Whorls seven, including the protoconch, which consists of a minute rounded up-standing initial whorl, followed by two smooth whorls with a median keel. Sculpture:—The upper and lower whorls have diverse patterns of sculpture; in the first adult, that is the fourth whorl, there is a flat sloping shoulder, margined by a sharp and prominent keel; anterior to the keel the whorl is vertical, and carries two spiral threads; under the keel spring faint radial riblets that vanish before they traverse the whorl. On the last whorl the contour changes from pagodiform to ovate, with a faint shoulder angle; below the suture run four fine close spiral threads,



followed about the periphery by three prominent cords, and again on the base and snout by nine evenly spaced spiral threads; over-ridden by these spirals are about thirteen oblique riblets, which are faint on the shoulder, prominent on the periphery, where they form with the spirals a conspicuous open net-work, and vanish on the base; on the penultimate there are seven spirals. Aperture:—The varix is prominent; under the free limb of it are five small entering plaits; the pillar is unarmed; the canal short, straight, and effuse. Length 1.5 mm., breadth 1.5 mm.

Apparently this is close to *Mangilia clarisculpta* Melvill,<sup>71</sup> which I have not seen, but the Australian species may be differentiated by having anterior spirals.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); 5 to 10 fathoms, Hope Island; 15 fathoms, Pabu Island; 5 fathoms, Van Diemens Inlet, Gulf of Carpentaria (self); 10 fathoms, Cape Sidmouth (Henn); 20 fathoms, off Endeavour Reef (McCulloch).

*ETREMA FIRMA* *sp. nov.*

(Plate xlvii., fig. 78.)

Shell small, very solid, and biconical. Colour ochraceous-buff, darkening on the spire and within the aperture to ferruginous. Whorls seven, including a protoconch of two and a half whorls, the last of which is sharply, delicately, keeled. Suture impressed and undulating. Sculpture:—The entire shell is encircled by comparatively coarse spiral threads, a pair of which on the periphery exceed the rest in size; on the last whorl these spirals amount to twenty-three, and on the penultimate to nine; the radials assume the form of peripheral tubercles, set at ten to a whorl; on the base each rib splits into two small riblets. Aperture:—The varix is large and prominent, having four teeth on the oral margin; sinus broad and pouting; canal short and open; columella lip crossed by four plications. Length 6 mm., breadth 3 mm.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type, self).

*ETREMA GLABRIPPLICATA* *Sowerby.*

(Plate xlvii., figs. 79, 80.)

*Glyphostoma glabriplicatum* Sowerby, Ann. Mag. Nat. Hist. (8), xii., 1913, p. 233, pl. iii., fig. 1.

? *Pleurotoma crassilabrum* var. *beta* Reeve, Conch. Icon., i., 1843, pl. xiv., fig. 118a.

*Glyphostoma crassilabrum* var. *minutissime-lirata* Bouge and Dautzenberg, Journ. de-Conch., lxi., 1914, p. 175.

This species is unrecorded for Australia. An example from Murray Island 13.5 mm. long, here figured, differs slightly from typical Japanese

<sup>71</sup> Melvill—Proc. Malac. Soc., x., 1912, p. 251, pl. xi., fig. 44.

examples by being broader, with more numerous ribs, and being speckled with brown. In these features it agrees with Lifuan material labelled "var. *delta*" by Hervier.<sup>72</sup>

*Hab.* Queensland:—Murray Island; Two Isles, off Cape Flattery; outer Barrier Reef, about S. lat. 14 (self).

*ETREMA LABIOSA* *sp. nov.*

*Clathurella crassilabrum* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 156 (not *Pleurotoma crassilabrum* Reeve, Conch. Icon., i., pl. xiv., fig. 118).

*Glyphostoma aliceæ* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 454, pl. xliii., fig. 88 (not *G. aliceæ* Melvill and Standen).

Shell large, solid, lanceolate. Colour buff, with chocolate stains on either side of both sinus and canal, a fainter chocolate band on base. Whorls ten, rounded. Sculpture:—Round-backed prominent ribs, set their breadth apart, twelve on the penultimate, arise below the suture and gradually vanish on the base; the spirals are coarse threads which over-ride the ribs and amount to thirty-five on the last whorl, five on the fasciole being small and uniform; on the periphery several minute threads are intercalated between the larger ones; on the snout are about twelve coarse spaced threads. Aperture fortified by a broad and high varix, expanding into a free edge with a serrate margin; within the margin are eight entering lyræ, the lowest twice as large as the others; inner lip with a substantial callus; on the lower part of the columella are two plications; canal short, open; sinus deeply incised, sub-circular. Length 14 mm., breadth 5 mm.

This species was confused by me with its near ally *E. aliceæ*. On closer examination that is found to differ by being larger, proportionately broader, and by having the spiral sculpture more developed, especially on the fasciole. *E. labiosa* occurs in the mud zone, while *E. aliceæ* is apparently confined to the clearest water. Another ally is *E. obtusirostrata* Smith, which has less prominent ribs and more even spirals. *E. crassilabrum* Reeve is a shorter broader shell than *E. labiosa*, with closer ribs and more even spirals. *E. globriplicata* Sowerby is distinguishable from *E. labiosa* by wider spaced radials, and by the unusually fine and even texture of the spirals. *E. culmea* Hedley has a broader shell than *labiosa*, with fewer ribs and more regularly alternating large and small spirals.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (self); 25 to 30 fathoms, Darnley Island (Brazier).

*ETREMA NASSOIDES* *Reeve*.

(Plate xlvii., fig. 81.)

*Pleurotoma nassoides* Reeve, Conch. Icon., i., 1845, pl. xxix., fig. 259.

*Mangelia nassoides* Hedley, Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 310.

<sup>72</sup> Hervier—Journ. de Conch., xliii., 1895, p. 236.

*Clathracella zonulata* Angas, Proc. Zool. Soc., 1867, p. 113, pl. xiii., fig. 17.  
*Id.* Brazier, Journ. of Conch., vi., 1889, p. 71. *Id.* Pritchard and  
 Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 178.

The types of both *notssoides* and *zonulata* are in the British Museum.

*Hab.* N.S. Wales:—Port Jackson, type of *zonulata* (Angas); Middle Harbour (Brazier); Gerringong; Twofold Bay (self). Victoria:—Western Port (Pritchard and Gatliff).

*ETREMA GRIFTEA* *sp. nov.*

(Plate xlvii., fig. 82.)

Shell small, rather solid, lanceolate, contracted at sutures, and excavate at the base. Colour uniform pale cinnamon, protoconch white, interior of aperture rufo-rose to orange-buff. Whorls seven, including the protoconch. Sculpture:—The ribs are prominent, round-backed, parted by hollow interstices, continuing obliquely up the spire, gradually vanishing on the base, and set nine to a whorl; ten main spiral cords encircle the body whorl, of which three ascend to the antepenultimate; these ride high over the ribs and bridge the interstices; a minute thread is intercalated between the wider spirals; these spirals are beset with sharp close grains, which give a harsh touch to the shell. Aperture oblong, rather narrow, protected by a prominent and massive varix; sinus a slight insinuation; canal short and broad; within the outer lip are five denticles, and two obscure folds cross the inner lip. Length 6 mm., breadth 2.5 mm.

*Hab.* Queensland:—5 fathoms, Van Diemens Inlet, Gulf of Carpentaria (type); 10 fathoms, Cape Sidmouth (Henn); Cairns (self).

*ETREMA PAUCIMACULATA* Angas.

*Mangelia cavernosa* Angas (not Reeve), Proc. Zool. Soc., 1865, p. 160.

*Glyphostoma paucimaculata* Angas, Proc. Zool. Soc., 1880, p. 416, pl. xl., fig. 7.

*Mangelia paucimaculata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 30. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 314. *Id.* May, Checklist of Mollusca of Tasmania, 1921, p. 109 (not of Melvill and Standen or of Bonge and Dautzenberg).

Sir J. C. Verco, who described the animal, notes that it has no operculum. May remarks that it was wrongly identified from Tasmania.

*Hab.* South Australia:—Aldinga and Holdfast Bays (type, Angas); Kangaroo Island (Verco). Western Australia:—Cottesloe (Henn); Sharks Bay (Captain W. Burrows).

Under the name of *Mangelia paucimaculata* there has been cited<sup>73 74</sup> from Lifu a shell of a different genus and species, smaller, and with fewer

<sup>73</sup> Melvill and Standen—Journ. of Conch., viii., 1897, p. 399.

<sup>74</sup> Bonge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 151.

slighter ribs, yet with a misleading superficial resemblance. As the story of the Lifuan species has been entangled with that of the South Australian, it seems well to deal with the error as detected, though the limits of this paper are thereby exceeded, and to offer the following description of the nameless shell.

*LIENARDIA FALSARIA* *n. sp.*

(Plate xlviii., fig. 88.)

Shell ovate-fusiform, very solid. Whorls six. Colour white, with ochraceous-orange as a peripheral zone, re-appearing on the spire, about the suture, again on the inner lip, and as a spot on the extremity of the snout. Sculpture:—The radial ribs are about nine to a whorl; not continuous from whorl to whorl; angled, and projecting at the shoulder, evanescent on the fasciole, but reappearing as a subsutural bead, on the last whorl diminishing towards the base, which they scarcely reach; both ribs and interspaces traversed by rather coarse, even, spiral threads. Aperture oblong, protected by a rather prominent arcuate varix, which is produced into a broad free edge, and incised by a rather deep sinus; inner lip with a stout tubercle at the sinus, and six horizontal ridges diminishing from above to below; on the opposite side are nine small pustules beneath the varix.

*Hab.* Loyalty Islands:—Lifu. New Caledonia.

*ETREMA POLYDESMA* *sp. nov.*

(Plate xlvii., fig. 83.)

Shell small, spire slender and much elevated, shoulder of the whorls angled, base a little concave. Colour buff, chestnut on the base and both sides of the mouth. Whorls seven, including a three-whorled protoconch of the usual type. Sculpture:—On the last whorl are twenty spirals, of which twelve are on the base and snout, and three on the shoulder; where the central series enlarge and cross over the radials they look like links in a chain; between these major spirals run microscopic hair-lines; on the last whorl are twelve perpendicular consecutive radials, which undulate the suture, attain greatest development on the periphery, and gradually disappear on the base. Aperture:—Varix large, with a peaked hump; beneath it are six small teeth; columella unarmed; sinus broad and expanding. Length 4.5 mm., breadth 1.5 mm.

This form was misidentified by myself<sup>75</sup> from Mast Head Island as *Glyphostoma polygonesiense*.

*Hab.* Queensland:—15 fathoms, Palm Islands (type); 5 to 10 fathoms, Hope Island; 5 to 8 fathoms, Murray Island; 4 to 14 fathoms, Albany Passage (self); 10 fathoms, Cape Sidmouth (Henn).

<sup>75</sup> Hedley—Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 481.

*ETREMA RAVELLA* sp. nov.

(Plate xlviii., fig. 84.)

Shell elongate biconic, a flat sloping shoulder and a perpendicular periphery giving it a pagodiform aspect. Colour buff, sometimes with pale yellow bands on the last whorl, on the outer lip lemon yellow, sometimes with chocolate on the pillar. Whorls seven, including the protoconch, which consists of a small rounded upstanding whorl, followed by two sharply keeled whorls. Sculpture:—On the last whorl are twenty-two spirals, of which three on the periphery are most prominent; the radials are not consecutive, they increase from nine on the early whorls to fifteen on the last; they are slight near the suture, prominent on the periphery, and absent on the base; they are over-ridden by the spirals, which form deep meshes on the periphery, a double row on the last whorl and a single one above. Aperture:—The prominent varix spreads a broad tooth-edged lip over the mouth; it is excavated above in a spout-like sinus; at the lip insertion is a massive coloured tubercle; within the lip are four or five entering plications; across the columella are two transverse plaits; canal short. Length 5 mm., breadth 2.2 mm.

This species is related to *E. elegans*, but that is smaller, more slender, with an unarmed columella, and lattice sculpture on the periphery.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); 8 fathoms, Weary Bay; 5 to 10 fathoms, Hope Island; 5 fathoms, Van Diemens Inlet; 5 fathoms, off Horsey River, Gulf of Carpentaria (self); 10 fathoms, Cape Sidmouth (Henn).

*ETREMA SPARULA* sp. nov.

(Plate xlviii., fig. 85.)

Shell large, broad, and comparatively thin, conic-fusiform, contracted at the base, turreted, last whorl about as long as the spire. Whorls eight, including the protoconch, which is mucronate of two whorls, the first flat-topped, the next keeled. Suture canaliculate. Colour buff, finely speckled with chestnut, the spots larger and darker near the suture, with a pale zone below the periphery. Sculpture:—The ribs are low, round-backed, sharply angled at the shoulder, vanishing on the base and round the fasciole area, spaced at twelve to a whorl; the whole shell is wrapped in sharp narrow threads, which swell on crossing a rib and shrink in the interval; they are parted by furrows deeper than wide, and support microscopic close-set transverse beads; on the penultimate there are about twenty-three and on the last whorl about sixty of these cords. Aperture:—The variceal ridge is tall and narrow, from which extends squarely a free limb dentate at the edge and slightly ribbed within; sinus rather deep and C-shaped; a callus tubercle at the right insertion is tricuspid; on the inner lip the callous sheet thins off to a fine edge, and has a few faint plications anteriorly; canal short, broad, and recurved. Length 17 mm., breadth 7.5 mm.

In this large species the unusual depth seems to have produced a thinner shell, in which the armature of the aperture is comparatively feeble.

*Hab.* South Australia:—100 fathoms, 40 miles south of Cape Wiles (type, self).

*EUREMA SPURCA* Hinds.

(Plate xlviii., fig. 86.)

*Clavatula spurca* Hinds, Proc. Zool. Soc., 1843, p. 39. *Id.* Hinds, Zool. "Sulphur," 1844, p. 17, pl. v., fig. 14. *Id.* Semper, Vehr. Ver. Hamburg, ii., 1876, p. 202.

*Pleurotoma spurca* Reeve, Conch. Icon., i., 1846, pl. xxxiv., fig. 312.

*Glyphostoma spurca* Sowerby, Proc. Malac. Soc., ii., 1896, p. 32.

*Lieardalia spurca* Schepman, Siboga Exped. Monogr. xlix., 1913, p. 434. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 184.

*Mangilia spurca* Odhner, Kung. Sv. Vet. Akademiens Handl., lii., 16, 1917, p. 58.

*Pleurotoma rara* Reeve (not Hinds), Conch. Icon., i., 1845, pl. xxviii., fig. 250.

A specimen referred to this species, 12.5 mm. long and 5 mm. broad, which I gathered in 1906, dead, on the beach at Cairns is here illustrated.

*Hab.* Queensland:—Cairns; Forsyth Island, Gulf of Carpentaria (self). Arafura Sea. Northern Territory:—32 to 36 fathoms, Port Darwin (Coppinger). Western Australia:—12 fathoms, Cape Jaubert, 45 miles W.S.W. (Mjöberg).

Var. *HUBERTI* Sowerby.

*Clathurella spurca* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 156.

*Pleurotoma spurca* Smith, Zool. "Alert," 1884, p. 39, pl. iv., fig. F.F1.

*Pleurotoma huberti* Sowerby, Proc. Zool. Soc., 1893, p. 487. pl. xxxviii., figs. 11, 12.

*Hab.* Queensland:—Port Molle (Coppinger); 13 fathoms, Princess Charlotte Bay; 20 fathoms, Cape Grenville (type); 30 fathoms, Darnley Island (Brazier); 4 to 14 fathoms, Albany Passage; Boyne Bar, Port Curtis (self).

*EUREMA TORTILABIA* sp. nov.

(Plate xlviii., fig. 87.)

*Clathurella donata* Brazier, Proc. Linn. Soc. N.S.W., i., 1874, p. 155 (not *Clavatula donata* Hinds, Zool. "Sulphur," ii., 1844, p. 22, pl. vii., fig. 7).

Shell small, solid, acicular, contracted at the base, and a little excavate below the suture. Whorls eight, three and a half of which form the protoconch, of which the apex is produced and the third whorl is keeled. Colour faded in my examples, but the oral callosities retain a brown or yellow stain. Sculpture:—On the upper whorls are two spirals, and on the last eleven, which become closer and smaller anteriorly; the radials are stout round-backed ribs, which bulge at the periphery of the upper whorls, and are set at seven or eight to a whorl. Aperture:—The mouth is triangular, contracted by a bend of the lip; sinus horizontal, spout-like, with a C section; columella with two or three small transverse plaits; canal short, a little recurved. Length 4·8 mm., breadth 1·6 mm.

This has a general resemblance to *Glyphostoma trigonostoma* Hervier,<sup>76</sup> but the Queensland shell is smaller, tapers more sharply to a point, is more contracted at the sutures, and has fewer spirals.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type); 5 to 10 fathoms, Hope Island (self); 20 fathoms, Darnley Island (Brazier); 20 fathoms, off Endeavour Reef (McCulloch).

#### *LIEUXARDIA Jousseanme.*

*Lieuxardia* Jousseanme, Bull. Soc. Zool. France, ix., 1884, p. 184, type *Clavatula rubida* Hinds.

*Thetidos* Hedley, Mem. Austr. Mus., iii., 1899, p. 472, type *Thetidos morsura* Hedley.

This well marked genus is a characteristic associate of reef corals. Typically the shell is brightly coloured. It is ovate, very solid, with stout undulating radial ribs crossed by sharp elevated cords. Within the lip and on the columella are entering denticles, but the columella denticles are more deep seated than in *Etrema*. The varix has a blunt labial margin; it does not extend a thin broad and wing-like expanse towards the aperture as with *Etrema*. The anal fasciole is traversed by spiral threads and is distinguished by the cessation of the radial sculpture, which does not intrude on a subsutural space. The sinus inclines to a subtubular form. The apex is small, and subulate with one smooth helicoid whorl followed by another glossy whorl with a sharp thread keel on the shoulder. The apex figured (Plate xlix., fig. 102) is from a specimen of *L. rubida* taken by myself under a stone at low tide in Milne Bay, Papua.

Under the subgeneric title of *Acrista*, with *L. paucifilla* Hedley for type, I now propose to distinguish a small party of diminutive shells:—*L. colata* Garrett, *disconica* Hervier, *gaidei* Hervier, *natchei* Jousseanme, *multiauda* Hedley, and *semilineata* Garrett, associated by a sculpture of compressed beads, trigonal aperture, and lop-sided apex.

*Thetidos* may serve for another subordinate group, including species with fewer and more massive labial denticles such as *L. morsura* Hedley, for the reception of which Pease<sup>77</sup> suggested "*Borsonia*."

<sup>76</sup> Hervier—Journ. de Conch., xliv., 1896 (1897), p. 93, pl. iii., fig. 23.

<sup>77</sup> Pease—Proc. Zool. Soc., 1860, p. 143.

*LIENARDIA BERTINIANA* Tapparone Canefri.

*Clathurella bertiniana* Tapparone Canefri, Bull. Soc. Zool. France, iii., 1878, p. 247, pl. vi., figs. 7, 8. *Id.* Conturier, Journ. de Conch., iv., 1907, p. 131.

*Hab.* Queensland:—Murray Island, Lizard Island, and Rocky Isle, off Cape Flattery (self).

*LIENARDIA CORTICEA* *sp. nov.*

(Plate xlviii., fig. 89.)

Shell small, solid, ovate-lanceolate, constricted at the sutures. Colour uniform ochraceous-buff. Whorls seven. Sculpture:—The radials increase in number but decrease in size as growth proceeds; on the penultimate are nine broad prominent and discontinuous ribs, which are cut into tubercles by the passage of spirals; on the last whorl are low and faint ribs which vanish on the base; the spirals on the last whorl amount to sixteen elevated coarse and evenly spaced cords, set at their breadth apart; on the penultimate the spirals are three; the persistent fasciole is traversed by two spiral threads, and is not interrupted by the radial sculpture. Aperture:—The month is narrow and arcuate; varix low but massive, ornamented by a continuation of the spiral threads; on the free edge of it are seven small denticles; sinns deep and rather wide; canal a mere notch; columella lip with a deeply seated plait, and with three or four superficial transverse plications. Length 5.5 mm., breadth 2.4 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*LIENARDIA FALLACIOSA* *sp. nov.*

(Plate xlviii., fig. 90.)

Shell small, subcylindrical, and solid. Colour apparently buff, with a brown band on the suture and another on the base. Adult whorls apparently five, angled on the shoulder and contracted on the base. Sculpture:—On the last whorl there are eight (including the varix) prominent radial ribs, and twelve evenly spaced spiral threads over-ride them. Aperture:—Month narrow; varix prominent, extending a limb inwards; canal and sinns wide. Length 4.5 mm., breadth 1.75 mm.

Material for this description is imperfect, consisting of four dead and discoloured shells; it may be supplemented by those who obtain better specimens. This new species is related to *L. fallax* G. and H. Nevill, but is shorter, stouter, and more coarsely sculptured.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self).

*LIENARDIA FALLAX* G. and H. Nevill.

(Plate xlviii., fig. 91.)

*Clathurella rugosa* var. *fallax* G. and H. Nevill, Journ. Asiatic Soc., xlv., 1875, p. 87.



*Glyphostoma fallax* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 177.

Identification of unfigured species without access to a type is always a matter of uncertainty. Some Queensland specimens, here regarded as a form of *L. fallax*, agree well with a series from Lifu. By being rather shorter, stouter, and more boldly ribbed, both the above slightly differ from a set from Reunion Island received under the name of *Glyphostoma fallax*. As all my Australian specimens are very worn from the beaches a drawing of a Lifuan shell is here presented.

*Hab.* Queensland:—Rocky Isle and Two Isles, both off Cape Flattery; Green Island (self).

*LIENARDIA FARSILIS* *sp. nov.*

(Plate xlviii., fig. 92.)

Shell small, very solid, biconical. Colour uniform white. Whorls six. Protoconch of one and a half smooth rather depressed whorls. Sculpture:—Ribs prominent, discontinuous, set eight to a whorl; spirals are fine evenly spaced threads, eleven on the last whorl and four on the penultimate; surface with a secondary sculpture of microscopic grains. Aperture:—Mouth triangular-pyriform, of moderate breadth; varix prominent, lip with a narrow free edge; sinus so shallow as to seem a mere bend from a profile view; looking into the mouth it is made plain by a tubercle on either side; within the lip are five entering plications; the columella has a faint deep-seated fold. Length 4.5 mm., breadth 2 mm.

This species is like a very diminutive *Heterocithara bilineata*.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type); 5 to 10 fathoms, Hope Island (self); 20 fathoms, off Endeavour Reef (McCulloch); Darnley Island (Brazier).

*LIENARDIA GILIBERTI* *Souverbie*.

*Pleurotoma giliberti* Souverbie, Journ. de Conch., xxii., 1874, p. 189, pl. vii., fig. 2.

*Borsonia giliberti* Tryon, Man. Conch., vi., 1884, p. 228, pl. xxv., fig. 58.

*Mangilia giliberti* Melvill and Standen, Journ. of Conch., viii., 1895, p. 97.

*Glyphostoma giliberti* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 179.

My specimens from Torres Straits represent a diminutive form two-thirds the length and stouter in proportion than typical Lifuan shells.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*LIENARDIA GRACILIS* *sp. nov.*

(Plate xlviii., fig. 93.)

Shell solid, elongate-ovate. Colour pale buff, with a few ferruginous streaks on the varix. Whorls six. Sculpture:—Fasciole area indeterminate; ribs narrow, elevated half the width of their interstices, running undiminished from suture to base, discontinuous from whorl to whorl, nine on the penultimate and eight on the last whorl; the spirals are fine cords that lace the interstices and bead the ribs, four on the penultimate and nine on the last whorl; within the meshes of the major sculpture run fine close filaments. Aperture:—Varix broad and prominent, denticulate on the inner margin by three teeth which decrease in descending order; sinus narrow and shallow; canal short and open. Length 4.5 mm., breadth 2 mm.

*Hab.* Queensland:—Barney Point, Port Curtis (type, Dr. H. L. Kesteven).

*LIENARDIA IMMACULATA* *Smith.*

(Plate xlviii., fig. 94.)

*Clathrella immaculata* Smith, Journ. Linn. Soc. Zool., xii., 1876, p. 539, pl. xxx., fig. 7.

In the Hargraves Collection of the Australian Museum there is a single specimen labelled "Bungaree Norah." Another series is from the geographically intermediate position of Wreck Reef, Coral Sea. Both agree with a set of Brazier's original series from Tarawa, an island of the Gilbert or Kingsmill Archipelago.

*Hab.* N.S.Wales:—Norah Head (W. H. Hargraves).

*LIENARDIA LUTEA* *Pease.*

(Plate xlviii., fig. 95.)

*Borsonia lutea* Pease, Proc. Zool. Soc., 1860, p. 143. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 398.

*Glyphostoma luteum* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 181.

*Mangilia thersyranum* Melvill and Standen, Journ. of Conch., viii., 1896, p. 291, pl. xi., fig. 33.

It is remarked by Bouge and Dautzenberg how difficult it is to identify a species unfigured and so poorly described as this. Different correspondents have sent me different shells under this name. As a contribution to the subject I add here a figure and description of a shell I collected at Lizard Island, Queensland, and identified by comparison with a shell from Osuni, Japan, sent to me under this name by Mr. H. Fulton.

Shell rather large and thin, fusiform turreted, and contracted at the base. Colour pale buff, with a suffused pale orange band round the base of the shell. Apex wanting in the specimen examined. Sculpture:—Ribs perpendicular, discontinuous, absent on the base and below the suture, set at about sixteen to a whorl; spirals smaller; about eleven lattice the intercostal spaces, four or five finer threads are crowded above the shoulder, and seven beaded cords run across the snout. Aperture:—The vertical and narrow mouth is protected by a massive varix which rises above the suture; edge of lip with eight small denticles; sinus a deep semicircular notch facing a deeply-seated tubercle across the aperture; half way down the columella is a deep-seated, fine, horizontal thread. Length 8.5 mm., breadth 3.5 mm.

*Hab.* Queensland:—Lizard Island; 17 to 20 fathoms, Masthead Island (self).

*LIEENARDIA MIGHELSI* *Iredale and Tomlin.*

(Plate xlix., fig. 96.)

*Pleurotoma rugosa* Mighels, Proc. Boston Soc. Nat. Hist., ii., 1845, p. 23.

*Id.* Conturier, Journ. de Conch., iv., 1907, p. 130 (not of Lea, Contrib. to Geol., 1833, p. 136, pl. iv., fig. 13; nor of Deshayes, Descr. Coq. Foss. Paris, ii., 1834, Moll., p. 486, pl. xlv., fig. 20).

*Borsonia rugosa* Pease, Am. Journ. Conch., iv., 1868, p. 105, and vii., 1871, p. 24.

*Clathurella rugosa* Langkavel, Donum Bismarek., 1871, p. 2, pl. i., fig. 5.

*Id.* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xlv., 1875, p. 86.

*Id.* Tryon, Man. Conch., vi., 1884, p. 297, pl. xix., fig. 57.

*Mangilia rugosa* Melvill and Standen, Journ. of Conch., viii., 1895, p. 97.

*Id.* Melvill and Standen, Journ. Linn. Soc., xxvii., 1899, p. 156. *Id.*

Melvill and Standen, Proc. Zool. Soc., 1901, p. 444.

*Glyphostoma rugosum* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484.

*Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 188.

*Lienardia rugosa* Schepman, Siboga Exped., Mongr. xlix., 1913, p. 438.

*Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 184.

? *Pleurotoma curculio* G. and H. Nevill, Journ. Roy. Asiat. Soc. Ceylon, 1870, p. 42.

? *Clathurella solida* Dunker, Malak. Blatt., xviii., 1871, p. 162.

? *Clathurella cincta* Dunker, *op. cit.*, p. 161, *jide* Garrett in Tryon.

*Lienardia mighelsi* Iredale and Tomlin, Journ. of Conch., xv., 1917, p. 216.

Both the identity and the nomenclature of this species are unsatisfactory. When bestowed by Dr. Mighels the name of *Pleurotoma rugosa* was doubly invalid. His type was lost by fire (Pease, 1868). The only figure that has been published (Langkavel, 1871) was not taken from that

type, and may be incorrect. The names of Nevill and of Dunker, referred here by Garrett, are unsupported by figures. Messrs. Iredale and Tomlin, who disregard Garrett's identifications, revive the species under a changed name. Perhaps it would have been preferable to have allowed Mighel's supposed species to expire under synonymy and to have introduced afresh the species believed to be his.

By the kindness of Mr. W. C. Clapp of the Agassiz Museum, Cambridge, Mass., I am enabled to figure a Tahitian example 7 mm. by 3 mm., from the Pense collection, of the traditional *rugosa*.

*Hab.* Queensland:—Murray Island (Haddon); Masthead Island (self).

*LIENARDIA MULTINODA* *sp. nov.*

(Plate xlix., fig. 97.)

Shell small, pointed, conical, contracted at the base. Colour light buff to white. Whorls five, of which two are nuclear. Protoconch almost subulate, the initial whorl first planulate, then suddenly and deeply descending, ornamented with minute delicate radial riblets. Sculpture consisting of square meshes, the knotting points of which project as tubercles; on the last whorl are eight spirals; of these there are three small ones on the snout, followed by a wider space than usual, and then by five cords stronger and wider apart; on the penultimate are three and on the antepenultimate two spirals; the radials are ten evenly spaced small sharp ribs, vertical, and continuing from whorl to whorl. Aperture:—The mouth is sinuate, the inner lip smooth, the outer armed with three tubercles; both sinus and canal are broad and shallow. Length 3.5 mm., breadth 1.5 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self).

*LIENÆDIA NIGROCINCTA* *Montrouzier*, var. *TRICOLOR* *Brazier*.

*Pleurotoma* (*Dejeania*) *nigrocincta* (err. typogr.) Souverbie and Montrouzier, Journ. de Conch., xx., 1872, p. 362.

*Pleurotoma* (*Dejeania*) *nigrocincta* Montrouzier, *op. cit.*, xxi., 1873, p. 56, pl. iv., fig. 2. *Id.* Fischer, *op. cit.*, xxiv., 1876, p. 151.

*Clathrella nigrocincta* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xliv., 1875, p. 89, pl. vii., fig. 6. *Id.* Hidalgo, Revista Acad. Madrid, i., 1904, p. 342.

*Pleurotoma* (*Glyphostoma*) *nigrocincta* Couturier, Journ. de Conch., iv., 1907, p. 131.

*Borsonia nigrocincta* Melvill and Stauden, Journ. of Conch., viii., 1897, p. 398.

*Glyphostoma nigrocinctum* Bouge and Dantzenberg, Journ. de Conch., lxi., 1911, p. 181.

*Clathurella tricolor* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 158.

*Glyphostoma tricolor* Hedley, Rec. Austr. Mus., iv., 1901, p. 122, pl. xvi., fig. 3.

This species is related to a shell usually, though perhaps incorrectly, known as a large form of *nigelsi*. From that *L. nigrocineta* is distinguished not only by the yellow band but also by greater breadth and solidity, more prominent sculpture, and fewer stouter spirals. The Queensland form is shorter (5·6 mm.), comparatively narrower, and with two spirals less than the typical form from New Caledonia.

*Hab.* Queensland:—Palm Islands, type of *tricolor* (Brazier); Cape York; Lizard Island; Eagle Island; Two Isles; and Rocky Isle (self).

*LIENARDIA PERISCCELINA* *sp. nov.*

(Plate xlix., fig. 98.)

*Clathurella rara* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 17 (not *Clavulula rara* Hinds, Zool. "Sulphur," ii., 1844, p. 17, pl. v., fig. 8).

Shell solid, narrowly elevate. Colour buff, with a brown line along the suture and another on the base. Whorls eight, inclusive of the protoconch. Sculpture:—The surface is microscopically grained; the radial ribs, which are prominent, perpendicular, and subcontinuous, commence below the suture and gradually vanish on the base; on the last whorl there are nine of these, exclusive of the varix. The penultimate has six and the last whorl seventeen spiral threads; of these the posterior three are small and close together, the next six are strong and evenly spaced, a wider space than usual then occurs in the hollow of the base, followed by three noduled spirals and concluded by five small spirals crowded on the anterior extremity. Aperture narrow, about a third of total length; varix moderately extended, edge thickened and bearing five or six denticles on the inner side; canal a little bent, short, and effuse; columella with from three to six external entering plaits. Length 8 mm., breadth 3·5 mm.

This shell has some likeness to the figure of *Pleurotoma compla* Reeve,<sup>75</sup> but is of more slender contour with bolder spirals.

*Hab.* Queensland:—12 fathoms, Torres Straits (type, Brazier); 5 to 8 fathoms, Murray Island; 4 to 14 fathoms, Albany Passage (self).

*LIENARDIA PUNCTILLA* *sp. nov.*

(Plate xlix., fig. 99.)

Shell small, solid, lanceolate. Colour dull white, with an orange line in each of the principal interstices. Whorls seven, of which two compose the protoconch. The initial whorl is turbinate, smooth, and wound so obliquely as to overhang the next on one side: the second is also smooth, with a peripheral thread keel. Sculpture:—There are six perpendicular

<sup>75</sup> Reeve—Conch. Icon., i., 1845, pl. xxxii., fig. 292.

subcontinuous radial ribs; these are crossed by cords which project on the summits of the ribs, and which amount to nine on the last whorl and four on the penultimate. Aperture trigonal, with a short open canal and a wide effuse sinus; the varix projects a free limb towards the mouth; on the columella are three transverse plaits, which lengthen in ascending order. Length 4.3 mm., breadth 2 mm.

This is nearly related to *L. brachyspira* Hervier. From Lifuan specimens of that form it differs by more slender contour, more contraction at the sutures, the ribs are more prominent, and the spirals more distinctly bridge the inter-radial hollows. For it is suggested the subgeneric group of *Aerista*.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self).

LIENARDIA RALLA *sp. nov.*

(Plate xlix., fig. 100.)

Shell small, solid, ovate-lanceolate, base constricted, snout recurved, spire turreted, and apex mucronate. Whorls eight, of which three and a half compose the protoconch. Colour pale buff, with a pale orange zone on the base. Sculpture:—Ribs set at about ten to a whorl, prominent, perpendicular, slightly interrupted from whorl to whorl at the suture, comparatively bolder on the upper whorls, and vanishing on the base; the spirals are close set cords crossing both ribs and their interstices, nodulous on the snout—on the last whorl twelve, and on the penultimate four. Aperture:—Mouth narrow, vertical; varix not prominent, edge of lip with six small inferior denticles; sinus subtubular; columella with a slight deeply-seated fold. Length 5 mm., breadth 3 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self).

LIENARDIA RHODACME *Melville and Standen.*

*Mangilia (Glyphostoma) rhodacme* Melville and Standen, Journ. of Conch., viii., 1896, p. 288, pl. ix., fig. 29, and 1897, p. 401.

*Glyphostoma rhodacme* Bonge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 186.

*Hab.* Queensland:—Two Isles, off Cape Flattery (self).

LIENARDIA ROSELLA *sp. nov.*

(Plate xlix., fig. 101.)

Shell small, solid, ovate-pointed. Colour rose-pink, with a chestnut-brown band below the suture, an indistinct pale zone on the periphery, and a faint brown line on the base. Whorls seven, including the protoconch; the second whorl of the latter is not keeled, and is more produced than in *L. rubida*. Sculpture:—The radial ribs are broad, rather prominent, and undulating; they commence below the fasciole and cease on

the base; on the last whorl there are nine ribs including the varix; spaced spiral cords amount to twelve on the last whorl and to six on the penultimate; on the brown fasciole are fine shagreen markings. Aperture:—The mouth is narrow, with four small, close, deep-seated columella folds and three blunt teeth within the outer lip; varix moderate; canal short, as wide as the aperture. Length 5 mm., breadth 2.5 mm.

At first glance this appears to be a dwarf form of *L. rubida*, but the different apex distinguishes it as another species.

*Hab.* Queensland:—Two Isles, off Cape Flattery (type, self); Wreck Reef, Coral Sea (Brazil).

*LIENARDIA ROSEOTINCTA* *Montrouzier*.

*Pleurotoma (Clathurella) roseotincta* Sowerbie and Montrouzier, Journ. de Conch., xx., 1872, p. 361. *Id.* Montrouzier, *op. cit.*, xxi., p. 55, pl. iv., fig. 1. *Id.* Semper, Verh. Ver. Hamburg, ii., 1876, p. 202.

*Clathurella roseotincta* Hidalgo, Revist. Acad. Madrid, i., 1904, p. 342. *Id.* Tapparone-Canefri, Bull. Soc. Zool. France, iii., 1878, p. 247.

*Glyphostoma roseotinctum* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 187.

? *Clathurella exquisita* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xliv., 1875, p. 87.

*Hab.* Queensland:—Lizard Island (self). Western Australia:—Bernier Island, Sharks Bay (Henn).

*LIENARDIA RUBIDA* *Hinds*.

(Plate xlix., fig. 102.)

*Clavatula rubida* Hinds, Proc. Zool. Soc., 1843, p. 39, and Zool. "Sulphur," ii., 1844, p. 18, pl. vi., fig. 6.

*Pleurotoma rubida* Reeve, Conch. Icon., i., 1845, pl. xxv., fig. 220.

*Defrancia rubida* Schmeltz, Mus. Godeffroy, Cat. iv., 1869, p. 90. *Id.* M'Andrew, Ann. Mag. Nat. Hist. (4), vi., 1870, p. 435.

*Lienardia rubida* Jousseanme, Bull. Soc. Zool. France, ix., 1884, p. 185.

*Mangilia rubida* Melvill and Standen, Journ. of Conch., viii., 1897, p. 398. *Id.* Sturany, Pola Exped. Moll., 1903, p. 251, pl. vii., fig. 3. *Id.* Tryon, Man. Conch., vi., 1884, p. 271, pl. xv., fig. 34.

*Glyphostoma rubidum* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 187. *Id.* Shirley, Proc. Roy. Soc. Queensland, xxiv., 1913, p. 56.

*Clathurella rubida* Hidalgo, Revist. Acad. Madrid, i., 1904, p. 342.

This species is the type of the genus *Lienardia*. The apex here figured is drawn from a specimen which I took alive under a stone at Milne Bay, Papua.

*Hab.* Queensland:—Cape York (Shirley).

*LIENARDIA STROMBILLA* *Hervier*.

*Glyphostoma strombillum* Hervier, Journ. de Conch., xliii., 1895, p. 151, and xliv., 1896, p. 83, pl. iii., fig. 22. *Id.* Bouge and Dautzenberg, Journ. de Conch., xli., 1913 (1914), p. 189. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 401. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island; 5 to 8 fathoms, Murray Island (self).

*LIENARDIA VULTUOSA* *Reeve*.

*Pleurotoma vultuosa* Reeve, Proc. Zool. Soc., 1845, p. 116, and Conch. Icon., i., 1845, pl. xxx., fig. 273.

*Lienardia vultuosa* Jousseaume, Bull. Soc. Zool. France, ix., 1884, p. 185.

*Clathurella vultuosa* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 51. *Id.* Hidalgo, Revist. Acad. Madrid, i., 1904, p. 343.

*Glyphostoma vultuosum* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 191.

*Hab.* Queensland:—Mast Head Island (self).

*HEMILIENARDIA* *Boettger*.

*Hemilienardia* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 52, type *Pleurotoma malleti* Recluz.

This genus is readily distinguishable from *Lienardia* by the apex. The protoconch consists of a cone of three and a half smooth rounded whorls. The succeeding adult whorls not only differ in sculpture, but are wound in so divergent a spiral and increase at so disproportionate a rate as to project that protoconch in a mucronate point. In the colour of the type the contrast is even more violent, as there the brilliant snow-white apex against the deep rose-red is visible to the naked eye. Another generic feature is an opaque peripheral zone. The deep-seated columella folds, so conspicuous in *Lienardia*, are here less developed. The species are small and usually brightly coloured. They frequent the upper zone of coral reefs.



HEMILIENARDIA APICULATA *Montrouzier*.

*Pleuratoma apiculata* Montrouzier, Journ. de Conch., xii., 1864, p. 264, pl. x., fig. 2.

*Glyphostoma apiculata* Semper, Verh. Ver. Hamburg, ii., 1876, p. 202. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 171.

*Lienardia apiculata* Jousseaume, Bull. Soc. Zool. France, ix., 1884, p. 185.

*Clathurella (Hemilienardia) apiculata* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 52. *Id.* Hidalgo, Revist. Acad. Madrid, i., 1904, p. 340.

*Clathurella apiculata* var. *minor* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xliv., 1875, p. 88, pl. vii., fig. 3.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island; Two Isles, off Cape Flattery (self).

HEMILIENARDIA APICULATA VAR. ALBOSTRIGATA *Baird*.

*Defrancia albostrigata* Baird, Cruise "Curagoa," 1873, p. 434, pl. xxxvii., figs. 3, 4.

*Mangilia udoppyrcha* Melvill and Standen, Journ. of Conch., viii., 1896, p. 288, pl. ix., fig. 28. *Id.* Tomlin, Journ. of Conch., xiii., 1910, p. 43.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

HEMILIENARDIA CALCICINCTA *Melvill and Standen*.

*Mangilia (Glyphostoma) calcicinctus* Melvill and Standen, Journ. of Conch., viii., 1896, p. 95, pl. iii., fig. 21.

*Glyphostoma calcicinctum* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 172.

*Hab.* Queensland:—Rocky Isle, off Cape Flattery (self).

HEMILIENARDIA GOBBINI *Hervier*.

(Plate xlix., fig. 103.)

*Glyphostoma gobbini* Hervier, Journ. de Conch., xliii., 1895 (1896), p. 149, and xliv., 1896, p. 75, pl. ii., fig. 17. *Id.* Bouge and Dautzenberg, *op. cit.*, lxi., 1914, p. 179.

*Mangilia gobbini* Melvill and Standen, Journ. of Conch., viii., 1897, p. 400.

Specimens from Torres Straits are smaller than typical Lifuan examples, being 4 mm. in length as against 5.5 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*HEMILIENARDIA HERSILIA* *sp. nov.*

(Plate xlix., fig. 104.)

Shell small, ovate-pointed, contracted at the sutures and at the base. Colour dull-white, an opaque white band at the back of the last whorl. Whorls seven, of which three are apical. Sculpture:—The radials are discontinuous, vertical, moderately prominent ribs, which diminish at the sutures and vanish on the base, and are set at ten to a whorl; the spirals are prominent cords which over-ride the ribs, four on the penultimate and twelve on the last whorl; of these the anterior five run across the snout, and are beaded. Aperture:—Mouth sinuate; varix composed of a double rib, the free limb traversed by eight spirals and the edge armed by four tubercles, becoming larger as they ascend, the lowest double; columella with two deep-seated plications; sinus and canal broad and shallow. Length 3.5 mm., breadth 1.7 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self); Palm Island (self).

*HEMILIENARDIA HOMOCHROA* *sp. nov.*

(Plate xlix., fig. 105.)

Shell small, solid, elongate-ovate. Colour entire deep rose pink, except an opaque white zone which is at first one spiral broad and at last three rows broad. Whorls eight, first three and a half apical, rapidly increasing. Sculpture:—The radials are twelve prominent round-backed ribs, ceasing on the base, discontinuous from whorl to whorl, and broader than their interstices; the spirals amount to sixteen on the last whorl, and to four on the penultimate; they are stout close set cords which traverse both ribs and interstices and continue on the base; there they carry large beads in continuation of the axes of the ribs; the whole surface is also microscopically shagreened. Aperture:—The mouth is vertical, contracted by the limb of the varix, the free edge of which is armed with five prominent tubercles; columella excavate and twisted; sinus deep and narrow. Length 5 mm., breadth 2.5 mm.

This is an Australian representative of *H. malleti* Recluz from the tropical Pacific. It is easily and definitely distinguished by having the protoconch coloured like the rest of the shell instead of being a brilliant white like that of *malleti*.

An example of this was found by Mr. J. Brazier in a rock pool, between tide marks, at Little Coogee, near Sydney, 19th July, 1895. Though immature it is quite sharp and fresh, and had evidently lived where it was found. Still I should consider that this species is not an ordinary resident of so southern a latitude, but that this individual was a waif swept down by the Notonectian current, perhaps in a larval state.

*Hab.* Queensland:—Two Isles, off Cape Flattery (type, self); Green Island (self). N.S. Wales:—Little Coogee (Brazier).

HEMILIENARDIA OCELLATA *Jousseaume*.

*Liencardia ocellata* Jousseaume, Bull. Soc. Zool. France, ix., 1884, p. 186, pl. iv., fig. k.

*Mangilia ocellata* Melvill and Standen, Journ. of Conch., viii., 1897, p. 401.

*Glyphostoma ocellatum* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 455. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 184.

*Hab.* Queensland:—Green Island (self).

HEMILIENARDIA THYRIDOTA *Melvill and Standen*.

*Mangilia (Glyphostoma) thyridota* Melvill and Standen, Journ. of Conch., viii., 1896, p. 292, pl. x., fig. 35, and 1897, p. 402.

*Glyphostoma thyridota* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 190.

*Hab.* Queensland:—Two Isles, off Cape Flattery (self).

HETEROCITHARA *gen. nov.*

A genus of the *Mangiliinae* related to *Paraclathurella*. Shell small, biconical, solid. Numerous perpendicular riblets extend from the suture to the base, and are over-run by smaller spiral cords, between which are dense microscopic hair lines. No fasciole; varix larger than the ribs; sinus small. Within the lip are a series of denticules. Type *Clathurella bilineata* Angas.

The Australian Tertiary fossils *Mangilia bidens* Tenison-Woods and *Clathurella obdita* Harris may be included here.

HETEROCITHARA BILINEATA *Angas*.

(Plate xlix., fig. 106.)

*Clathurella bilineata* Angas, Proc. Zool. Soc., 1871, pp. 18, 93, pl. i., fig. 23.

*Mangilia bilineata* Gatliff and Gabriel, Proc. Roy. Soc. Victoria, xxv., 1912, p. 170.

The types are five specimens from Port Jackson presented to the British Museum by G. F. Angas.

*Hab.* N. S. Wales:—Sow and Pigs Reef, Port Jackson (type, Angas); Lake Macquarie (Cherry); Port Stephens (Museum Expedition). Victoria:—Port Albert (Worcester).

*HETEROCITHARA CONCINNA* *sp. nov.*

(Plate xlix., fig. 107.)

Shell small, slender, cylindro-fusiform. Colour pale buff, with a few broken ferruginous lines on the back of the last whorl, on the varix, and in the subsutural intercostal spaces. Whorls seven, rounded, constricted at the suture, and subangled at the shoulder. Protoconch of two and a half whorls, smooth, symmetrical, conical. Sculpture:—Ribs prominent, narrow, as broad as their interstices, proceeding from suture to base, but discontinuous from whorl to whorl; spirals are sharp widely spaced threads traversing both ribs and interstices, but more conspicuous in the latter, amounting to four on the penultimate and thirteen on the body whorl, the one on the shoulder being more important than the rest; besides the major spiral other close and minute threads over-run the fasciole area. Aperture:—Mouth wide, unarmed; varix narrow but elevated; sinus deeply excavate; canal short and wide. Length 5 mm., breadth 1.5 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*HETEROCITHARA ERISMATA* *sp. nov.*

(Plate xlix., fig. 108.)

Shell ovate-elliptical, very solid. Colour pale cream, spotted with square dots of raw sienna upon the ribs between the spirals. Whorls six, plus the protoconch. Sculpture:—Surface rather glossy, with fine radial microscopic scratches; radials prominent, close-set, discontinuous ribs, wider spaced on the back of the last whorl, amounting to nine on the penultimate; the spirals are chiefly apparent as beads upon the ribs, but suddenly enlarge upon the snout to massive tubercles; on the last whorl there are nine, on the penultimate three, and on the antepenultimate two. Aperture:—Mouth narrow, vertical; varix prominent, the spirals that cross it are magnified into seven outstanding knuckles; sinus a deep U-shaped incision in the varix; canal very short; no plications or denticles within the outer lip or on the columella. Length 7.5 mm., breadth 3.5 mm.

This species has a general resemblance to *Mangelia bascauda*,<sup>79</sup> but differs by larger size, more prominent radials, and especially in the absence of teeth in the aperture.

*Hab.* Queensland:—Lady Elliot Island (type, Miss Lovell); Caloundra (Prof. T. H. Johnston); Facing Island, Port Curtis (Dr. H. L. Kesteven).

*HETEROCITHARA HIRSUTA* *De Folin.*

*Planorbium hirsutum* De Folin, Les Meleagrinicoles, 1867, p. 59, pl. v., fig. 16.

*Mangelia hirsuta* Tryon, Man. Conch., vi., 1884, p. 270, pl. xxx., fig. 75.

<sup>79</sup> Melvill and Standen—Journ. of Conch., viii., 1896, p. 279, pl. ix., fig. 13.

*Clathurella hirsuta* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 198.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self); Mast Head Island (self).

HETEROCITHARA RIGORATA *Hedley*.

(Plate I., figs. 109, 110.)

*Mangilia rigorata* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 459, pl. xlv., figs. 98, 99.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type, self); 20 fathoms, Darnley Island ("Chevert").

HETEROCITHARA SERILIOLA *sp. nov.*

(Plate I., fig. 111.)

Shell subcylindrical, turreted, apex pointed. Colour undetermined. Whorls eight. Sculpture:—Ribs narrow, elevated, round-backed, alternating from whorl to whorl, in-bent at the summit, the shaft perpendicular and the base out-curved, thirteen on the penultimate and eleven on the last whorl, the rib before the varix evanescent; spirals are prominent cords crossing both ribs and interspaces, on the upper whorls three or four, on the last twelve; the uppermost spiral accentuates the shoulder angle; two or three on the base are thicker than the rest; the interspaces have microscopic grains set in canvas pattern. Aperture:—The mouth is long, narrow, and unarmed; varix larger than the ribs, rising at the insertion, the edge of its outer limb crenulated by spirals; sinus rather broad; columella perpendicular; canal short and broad. Length 9 mm., breadth 3 mm.

This is related to *H. rigorata*, but is easily distinguished by its far larger size. *P. gracilentia* is comparable in size, but differs by its blunt apex, slighter ribs, and more fusiform contour.

*Hab.* Queensland:—12 fathoms, Torres Straits (Brazier).

HETEROCITHARA TRANSENNA *sp. nov.*

(Plate I., fig. 112.)

Shell small, very solid, ovate-acuminate, turreted. Colour faded to a uniform gray. Whorls six. The protoconch is composed of two small smooth elevated whorls. Sculpture:—The radials are prominent perpendicular discontinuous ribs, which are dislocated at but continue on the snout; they are nodose at the passage of the spirals, and wider spaced on the last whorl, being set at the rate of ten on the penultimate and eight on the last whorl; the spirals are strong evenly-spaced threads, nine on the last whorl and three on the one before. Aperture:—Varix broad and prominent, almost closing up the mouth; sinus open and rather shallow; canal a mere notch. Length 5 mm., breadth 2 mm.

This has some resemblance to *Mangilia diatula*,<sup>80</sup> but the sculpture of the Queensland shell is much harsher and the mouth narrower.

*Hab.* Queensland:—4 to 14 fathoms Albany Passage (type); 5 to 10 fathoms, Hope Island; Two Isles, off Cape Flattery; Hinchinbrook Island (self); Cape Grenville and Darnley Island ("Chevert").

HETEROCITHARA TRIBULATIONIS *Hedley*.

*Glyphostoma tribulationis* Hedley, Proc. Linn. Soc. N.S.W., xxiv., 1909, p. 454, pl. xlii., fig. 81.

This species is related to *H. zebuensis* Reeve, but is stouter and more strongly featured.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 5 to 8 fathoms, Murray Island (self); 20 fathoms, off Endeavour Reef (McCulloch).

HETEROCITHARA ZEBUENSIS *Reeve*.

(Plate I., fig. 113.)

*Mangilia zebuensis* Reeve, Conch. Icon., iii., June 1846, pl. viii., fig. 68, and Proc. Zool. Soc., August 1846, p. 65. *Id.* Tryon, Man. Conch., vi., 1884, p. 266 (as *M. derelicta*). *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 180.

*Mangilia cebuensis* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 44.

*Cithara zebuensis* Hidalgo, Revist. Acad. Cienc. Madrid, 1904, p. 839.

My figure is derived from a Hope Island specimen which was identified by comparison with Singapore material kindly given to me under this name by Mr. J. R. le B. Tomlin.

*Hab.* Queensland:—Mornington Island; 4 to 14 fathoms, Albany Passage; Rocky Isle, off Cape Flattery; 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Island; 17 to 20 fathoms, Mast Head Island (self).

ANACITHARA *gen. nov.*

A genus of the *Mangiliinae* proposed to embrace small shells which resemble *Encithara* in their upper whorls and sculpture, but differ in their wide aperture, devoid of teeth on either side. Type *Mangilia nanufragu* Hedley.

Besides the Australian species subsequently enumerated, the following exotic species may be assigned to *Anacithara*:—*Mangilia dulcina* Melvill and Standen, 1895; *Drillia tone* Melvill and Standen, 1896; and *Mangilia osunienensis* Sowerby, 1913.

<sup>80</sup> Hervier—Journ. de Conch., xlv., 1897 (1898), p. 59, pl. viii., fig. 7.

*ANACITHARA BREVICOSTATA* sp. nov.

(Plate I., fig. 114.)

Shell small, thin, elongate-ovate. Colour pale buff, with a narrow subsutural band. Whorls rounded, six, including the protoconch, which is smooth, turbinate, slightly tilted, and of two whorls. Sculpture:—The ribs rather prominent, rounded, broader than their interstices, on the penultimate nine, on the last whorl ten; these are spaced more widely than those above, commencing at the suture and terminating rather abruptly at the periphery; the spirals even, comparatively coarse, and close-set threads, which over-run the whole shell. Aperture wide, unarmed, varix slight; sinus indistinct; canal a mere notch. Length 4·5 mm., breadth 2 mm.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island (self).

*ANACITHARA CAELATURA* sp. nov.

(Plate I., fig. 115.)

Shell fusiform, small, rather solid. Colour buff, with an indistinct pale ferruginous band on the shoulder. Whorls six, rounded above, constricted at the sutures, and contracted at the base. Sculpture:—The ribs are perpendicular, narrow, widely spaced, not continuing from whorl to whorl; on the penultimate nine, on the last eight; fine even close-set spirals over-run the whole shell. Aperture wide, unarmed; varix high and broad; sinus wide and rather deep; canal short and broad. Length 4·5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ANACITHARA CONATA* Hedley.

*Mangelia naufraga* var. *conata* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 458, pl. xlv., fig. 94.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 17 to 20 fathoms, Mast Head Island (self).

*ANACITHARA EXQUISITA* sp. nov.

(Plate I., fig. 116.)

Shell small, biconical. Colour uniform pure white. Whorls six, turreted. Protoconch two smooth, elevated, symmetrical whorls. Sculpture:—Ribs rather low and rounded, discontinuous from whorl to whorl; on the penultimate there are eight, which become shorter, lower, wider spaced, and tend to disappear; fine, dense, even spiral threads over-run the whole surface. Aperture open, unarmed; varix well developed; sinus a semicircular incision; canal open, short. Length 4·5 mm., breadth 2 mm.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island (self).

*ANACITHARA HEBES* *sp. nov.*

(Plate I., fig. 117.)

Shell solid, biconical, small. Colour uniform white. Whorls six, and angled at the shoulder. Sculpture:—Low, rounded, and close-set ribs, numbering eleven on the penultimate, and becoming evanescent on the last whorl; spirals are close fine threads, nearly uniform in size and spacing, crossing ribs and interstices alike, and extending over the whole whorl from the suture downwards, numbering about six on the penultimate and twenty-two on the last whorl. Aperture wide, unarmed; varix slight; sinus shallow; canal a mere notch. Length 5.5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ANACITHARA HERVIERI* *sp. nov.*

(Plate I., fig. 118.)

Shell small, elongate, turreted. Colour dull white; protoconch pale primrose yellow. Whorls six. Sculpture:—Ribs low, distant, perpendicular, angled at the shoulder, running from suture to base, but not continuing from one whorl to another; on the penultimate seven; spirals very slender and widely-spaced threads, between which are a few still finer threads; of the major series there are twelve on the last and four on the penultimate whorl. Aperture open, unarmed save for a tubercle on either side of the sinus; varix well developed; sinus wide and shallow; canal merely a notch. Length 5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ANACITHARA LEPTALEA* *sp. nov.*

(Plate I., fig. 119.)

Shell small, solid, narrowly ovate. Colour uniform white. Whorls six, including a smooth two-whorled protoconch. Sculpture:—Prominent ribs, parted by their own breadth, are set at nine or ten to a whorl; both ribs and interstices are traversed by a series of uniform sharp spiral threads—six on the penultimate and thirteen on the last whorl. Aperture narrow, protected by a broad and high varix; canal short and open; sinus a semicircular notch; there are no denticles on the lips, but a deeply-seated fold is just visible on the columella. Length 3.5 mm., breadth 1.5 mm. Compared with *Mangilia nanisca* this is broader, with more numerous ribs and coarser spirals.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ANACITHARA NANISCA* *Hervier.*

*Mangilia nanisca* Hervier, Journ. de Conch., xlv., 1897, pp. 55, 186, pl. viii., fig. 5. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 153.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).



*ANACITHARA NAUFRAGA Hedley.*

*Maugilia naufraga* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 458, pl. xlv., fig. 93.

*A. naufraga* is like *A. dulcinea* Melvill and Standen, from Lifu, but appears to differ specifically by stouter build and bolder ribs.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 5 to 8 fathoms, Murray Island; 17 to 20 fathoms, Mast Head Island (self).

*ANACITHARA PROPINQUA sp. nov.*

(Plate I., fig. 120.)

Shell small, rather solid, ovate-fusiform. Colour uniform pale buff or uniform pale lilac. Whorls six. Protoconch slightly tilted. Sculpture:—Ribs rather prominent, rounded, set their own breadth apart, discontinuous from whorl to whorl, those on the last whorl gradually vanishing below the periphery; nine on the penultimate; fine, close, even spiral threads over-run the whole shell. Aperture wide, unarmed; varix massive; sinus rather shallow; canal short and wide. Length 4.2 mm., breadth 2 mm.

Related to *A. naufraga* Hedley, from which it differs by being smaller, less cylindrical, and having slighter ribs.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

*ANACITHARA RISSOINA sp. nov.*

(Plate I., fig. 121.)

Shell rather solid, elongate, rounded at the base, blunt at the apex. Colour dull white, with faint orange spots on the back of the last whorl. Whorls six, rounded and constricted at the sutures. Sculpture:—The ribs are rounded and placed their breadth apart, alternate from whorl to whorl, undulate the suture, extend to the base, and number twelve on the penultimate; the spirals are fine threads of uniform size and spacing, crossing both ribs and interstices, extending over the whole whorl except the fasciole area, numbering eight on the penultimate and twenty on the last whorl. Aperture wide, unarmed; varix broad and high; sinus wide and shallow; canal a mere notch. Length 6 mm., breadth 2 mm.

This species resembles *Clathurella lila* Melvill and Standen,<sup>81</sup> but is much larger, broader in proportion to length, with ribs wider apart, and the spirals more numerous. From *A. naufraga* Hedley it differs by greater length and less breadth, by less prominent, closer, and more numerous ribs, by coarser and more widely-spaced spirals.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (self).

<sup>81</sup> Melvill and Standen—Journ. of Conch., viii., 1896, p. 294, pl. x., fig. 39.

*ANACITHARA ROBUSTA* *sp. nov.*

(Plate li., fig. 122.)

Shell small, solid, biconical. Colour dull white, apex pink. Whorls six, including the protoconch. Sculpture:—Ribs prominent, discontinuous from whorl to whorl, projecting at the periphery and gradually vanishing on the base; nine on the penultimate; very many and close spiral threads over-run both ribs and interstices; two spirals, larger and wider spaced than the rest, traverse the periphery and ascend the spire. Aperture:—The mouth is protected by a thick varix, from which a free limb, insinuate at the base, projects into the aperture; sinus semicircular; canal short and open. Length 5.5 mm., breadth 2 mm.

*Hab.* Queensland:—4 to 14 fathoms, Albany Pass (type); 5 to 8 fathoms, Murray Island; 5 to 10 fathoms, Hope Island (self).

*ANACITHARA STRICTA* *sp. nov.*

(Plate li., fig. 123.)

Shell subcylindrical, blunt at either end. Colour uniform pale buff. Whorls five and a half. Protoconch depressed, asymmetrical. Sculpture:—Ribs slight and inconspicuous, their own breadth apart, those on the last whorl descending from the suture only to the periphery; fourteen on the penultimate, and as many on the last whorl; these are dominated by the spirals, which are coarse, wide-spaced, and amount to eighteen on the last whorl. Aperture wide and unarmed; varix slight; sinus indistinct; canal short and wide. Length 4.5 mm., breadth 1.5 mm.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island (self).

*ANACITHARA TUMIDA* *sp. nov.*

(Plate li., fig. 124.)

Shell ovate, thin. Colour uniform white, or white with narrow ochraceous spiral lines. Whorls inflated, six, including the protoconch, which is smooth, subdiscoidal, tilted to one side, and projecting over the next whorl. Sculpture:—Ribs broad and rounded, well spaced, discontinuous from one whorl to another, nine on the penultimate, gradually vanishing towards the base; both ribs and interstices over-run by fine dense spiral threads. Aperture wide; lip simple. Length 5.3 mm., breadth 2 mm.

*Hab.* Queensland:—20 fathoms, Endeavour Reef (McCulloch).

*ANACITHARA UNDATICOSTA* *Reeve.*

*Pleurotoma undaticosta* Reeve, *Conch. Icon.*, i., 1845, pl. xxxi., fig. 284, and *Proc. Zool. Soc.*, 1845 (1846), p. 117.

*Mangelia undaticosta* Brazier, *Proc. Linn. Soc. N.S.W.*, i., 1876, p. 161.

This identification of the "Chevert" shells is doubtful.

*Hab.* Queensland:—11 fathoms, Cape York (Brazier).

PARACLATHURELLA *Boettger*.

*Paraclathurella* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 56, type *Pleurotoma gracilentum* Reeve.

In *Paraclathurella* Dr. Boettger established a valid genus for *P. gracilentum* and its varieties, but his classification appears to have depended on superficial characters of subcylindrical form and delicate sculpture in which spirals exceed radials, for his judgment was depreciated by the addition of the following incongruous species—*P. axis* Reeve, *crinita* Reeve, *insculpta* Adams and Angas, *livata* Reeve, *rissoides* Reeve, and *subula* Reeve—here distributed among *Hemidaphne* and *Guraleus*.

*Paraclathurella* has the first two whorls (protoconch) depressed-turbinate, quite smooth, the initial one a little tilted. Sculpture commences with the advent of four minutely-beaded spirals. Radials follow, develop a reticulation, become wider spaced, and gradually predominate, thus introducing the adult sculpture. A secondary microscopic sculpture later occurs of grained threads. Varix narrow, in which is excavated a squarely U-shaped sinus; outer lip with a narrow free edge; no teeth on columella or lip.

These characters I read as indicating a relationship with *Eucithara*; from that *Paraclathurella* is distinguished by elongate form, radial sculpture, and toothless mouth.

PARACLATHURELLA ADITICOLA *sp. nov.*

(Plate li., fig. 125.)

Shell of moderate size for the genus, cylindro-fusiform. Whorls seven. Colour uniform buff. Sculpture:—Radials consist of distant, low, round-backed ribs, discontinuous from whorl to whorl, undulating the surface, and set about eight to a whorl; on the upper whorls the ribs are comparatively closer and higher; on the last whorl are about twenty fine grooves, cutting the surface into flat-topped spirals; on the penultimate there are about ten of these. Aperture:—The mouth is elongate-pyriform, without teeth on either side; no varix; outer lip thin, and scarcely inflected at the sinus; canal a notch. Length 8 mm., breadth 2.5 mm.

Compared with *P. gracilentum* var. *portia* Smith, the shape of the novelty is more fusiform, and the whorls increase slower, the spirals smaller and more numerous, but the radials are fewer and more prominent.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); Mapoon (self).

PARACLATHURELLA CLOTHONIS *sp. nov.*

(Plate li., fig. 126.)

Shell small, slender, cylindro-fusiform. Colour uniform dull grey. Whorls six, of which half comprise the protoconch, the first two whorls of which are smooth, the next sculptured with radial arcuate wrinkles.

**Sculpture:**—The adult shell is wound round and lengthwise, as it were, with sharp threads, which produce a point at intersection and enclose deep square meshes; the spirals are thirteen on the last whorl and four on the penultimate; the radials are sixteen on the last whorl. **Aperture:**—The mouth is rather wide; columella unarmed and excavate; sinus broad and shallow; outer lip extending a thin edge; canal a mere notch. Length 4 mm., breadth 1·8 mm.

**Hab.** Queensland:—8 fathoms, Weary Bay (type); 15 fathoms, Palm Island; 4 to 14 fathoms, Albany Passage; 5 fathoms, Horsey River (self); 10 fathoms, Cape Sidmouth (Henn); 20 fathoms, off Endeavour Reef (McCulloch).

PARACLATHURELLA GRACILENTA *Reeve*.

*Pleurotoma gracilentum* Reeve, Conch. Icon., i., 1843, pl. xiv., fig. 114, and Proc. Zool. Soc., 1843 (1844), p. 184. *Id.* Smith, Proc. Zool. Soc., 1879, p. 195, pl. xix., fig. 24, and Zool. Coll. "Alert," 1884, p. 39.

*Mangelia gracilentum* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 161. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 456, pl. xlv., fig. 91. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 170, pl. ix., fig. 12.

*Clathurella gracilentum* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 57. *Id.* Hidalgo, Revist. R. Acad. Cien. Madrid, i., 1904, p. 341.

*Pleurotoma contracta* Reeve, Conch. Icon., i., 1843, pl. xiv., fig. 116, and Proc. Zool. Soc., 1843 (1844), p. 185.

*Mangelia contracta* Brazier, Proc. Linn. Soc., i., 1876, p. 161.

*Pleurotoma fusoides* Reeve, Conch. Icon., i., 1846, pl. xxxviii., fig. 439, and Proc. Zool. Soc., 1846, p. 6.

*Pleurotoma portia* Smith, Ann. Mag. Nat. Hist. (5), xiv., 1884, p. 317.

*Cythara elegantissima* Melvill, Ann. Mag. Nat. Hist. (7), xii., 1903, p. 319, pl. xxiii., fig. 13.

*Mangelia elegantissima* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 433.

**Hab.** Queensland:—32 to 36 fathoms, Arafura Sea ("Alert"); 20 fathoms, Darnley Island; 11 fathoms, Cape York (Brazier); 10 fathoms, Cape Sidmouth (Henn); 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Island; Mapoon; off Horsey River (self).

PSEUDORHAPHITOMA *Boettger*.

*Pseudorhaphitoma* Boettger, Nachr. dent. Malak. Gesell., xxvii., 1895, p. 56, type *Mangelia fairbanki* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xlv., 1875, pt. ii., p. 85, pl. vii., fig. 2.

Besides his type Dr. Boettger also included in his new section *Drillia fortificata* Smith, *Clathurella obeliscus* Reeve, and *Mangelia hexagonalis*

Reeve. Thus was indicated a group, related to *Euclithara*, of elongate, many whorled shells, uniform brown or white in colour, the mouth contracted by a sharp free lip springing from a prominent varix, within which are some entering ridges, and above these a well-cut sinus. Sculpture:—Prominent and continuous longitudinal ribs, crossed by fine, and sometimes coarse, spiral grained threads.

Some West American species which have been referred to *Agathotoma* Cossmann<sup>82</sup> by Dr. Dall<sup>83</sup> have much resemblance to *Pseudorhaphitoma*.

Misapprehension about the type of the genus seems to be general, for I have received from correspondents two different species under the name of *M. fairbanki*, neither of which agrees with Nevill's figure. So to re-establish this genus I applied to the Director of the Zoological Survey of India for a loan of Nevill's type. This he most generously placed at my disposal, and the opportunity is now taken to re-describe and to re-figure it. Thus:—

*PSEUDORHAPHITOMA FAIRBANKI* Nevill.

(Plate li., figs. 127, 128, 129.)

Shell narrowly conical, solid. Colour uniform cinnamon-drab, except the first two whorls which are hyaline white. Whorls eight, gradually increasing. Sculpture:—The second whorl has a nepionic sculpture of numerous fine radial riblets; the remainder of the shell is traversed by six prominent stout spaced radial ribs, which ascend the spire vertically and without interruption. These are crossed by fine and coarse spirals; the major spirals are ten on the last whorl, four on the penultimate, and three on the previous whorls; they form polished beads on the crests of the ribs; between each major spiral run six to eight microscopically-beaded threads. Behind the aperture the suture first ascends slightly, then descends abruptly. The final rib, more massive than its fellows, forms a varix in which is excavated a semicircular sinus, and from which an inbent lip contracts the mouth. Within the outer lip are four denticles, and on the inner lip is a raised callus pad. Canal short and broad. Length 6.2 mm., breadth 2.3 mm.

*Hab.* India:—Bombay.

*PSEUDORHAPHITOMA ALTICOSTATA* Sowerby.

(Plate li., fig. 130.)

*Mangilia alticostata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31, pl. iii., fig. 16. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 17. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 313. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 167.

*Hab.* South Australia:—12 to 15 fathoms, St. Vincents Gulf (type); 40 fathoms, Neptune Island (the shell here figured); 44 fathoms, Cape

<sup>82</sup> Cossmann—Rev. Crit. Pal., iii., 1889, p. 1, new name for *Ditoma* Bellardi, type *Mangilia angusta* Jan.

<sup>83</sup> Dall—Proc. U.S. Nat. Mus., lvi., 1920, p. 79.

Borda; 40 to 150 fathoms, Beachport; 24 fathoms, Newland Head; 15 to 20 fathoms, St. Francis Island; Wallaroo and Port Adelaide (Verco). N.S.Wales:—Middle Harbour, Port Jackson (self).

*PSEUDORHAPHITOMA AXICULA* *sp. nov.*

(Plate li., fig. 131.)

*Mangelia hexagonalis* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 162  
(not *Pleurotoma hexagonalis* Reeve, Conch. Icon., i., 1845, pl. xxxii., fig. 293).

Shell solid, subcylindrical, base rounded, sides flat, and summit delicately tapered. Colour pale buff, uniform but for a tinge of lilac on the columella. Whorls, including the protoconch, nine. Protoconch with the initial whorl tilted, the first and second smooth and helicoid. Suture linear. Sculpture:—A clathrate sculpture is developed on the third whorl, the next is bicarinate; later the keels diminish and vanish; the ribs are six to a whorl, elevated, stout, and distant, descending the spire perpendicularly and continuously; at the anterior extremity the ribs run across the snout; the spirals are even closely-packed threads, numbering about seventeen on the penultimate, and about forty on the last whorl. Aperture:—Mouth very narrow, without denticles on either side; the varix is of the calibre of the preceding ribs; its insertion does not rise above the plane of the suture, and it fills the interval between two ribs of the preceding whorl; sinus small and shallow; columella perpendicular; canal short and broad. Length 8 mm., breadth 2 mm.

From its associates in the genus this species differs as follows:—From *P. alticostata*, which is nearest, by less elevated ribs and coarser spirals and narrower form; from *P. pyramis* Hinds, by narrower form; from *P. aqua* Melvill and Standen, by larger size, straighter ribs, more slender form, and coarser spirals; and from *P. multigranosa* Schepman, by more even sculpture, smaller size, and narrower form.

*Hab.* Queensland:—8 to 12 fathoms, Torres Strait (type, Brazier); 4 to 14 fathoms, Albany Passage (self).

*PSEUDORHAPHITOMA BIPYRAMIDATA* *sp. nov.*

(Plate li., fig. 132.)

Shell small, rather solid, lanceolate. Colour uniform white. Whorls eight, including the protoconch. The latter has two and a half whorls, the first two being smooth and helicoid; the next half whorl carries about ten sharp, narrow, arcuate, radiate riblets, quite discordant with the succeeding sculpture. The adult whorl begins abruptly with seven prominent ribs, which descend the whorls vertically and continuously; these are traversed by spaced spiral cords which commence with two on the third whorl and end with seventeen on the last. Between these cords run from two to six rows of densely packed microscopic grains. Aperture sublinear; the thick and outstanding varix extends a broad lip over the mouth; sinus semi-circular, cut out of the varix, with a substantial tubercle on the right

and another on the left; there are no other teeth within either lip; on the columella is a thick and smooth sheet of callus. Length 5 mm., breadth 2 mm.

There is a species from the Persian Gulf which, though rather larger, seems to be otherwise identical, and which has been distributed as *Mangilia fairbanki* and as *Mangilia scitula*, neither of which names are applicable. I have also seen *P. bipyramidata*, from the Isle of Pines, New Caledonia. Along the Great Barrier Reef this species seems common and generally distributed.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type); 4 to 14 fathoms, Albany Passage; 5 to 10 fathoms, Hope Island; 15 fathoms, Palm Island; 4 fathoms, Van Diemens Inlet, Gulf of Carpentaria (self); 20 fathoms, off Endeavour Reef (McCulloch).

*PSEUDORHAPHITOMA CALCATA Hedley.*

*Mangilia calcata* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 456, pl. xlv., fig. 90.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 5 to 8 fathoms, Murray Island (self).

*PSEUDORHAPHITOMA CRUELIS sp. nov.*

(Plate li., fig. 133.)

Shell small, rather solid, lanceolate, constricted at the suture, and contracted at the base. Colour uniform pale buff. Whorls eight, of which three constitute the protoconch. Sculpture:—The ribs are seven to a whorl, slightly oblique to the axis, low and round-backed, decreasing in prominence as growth proceeds, continuing from whorl to whorl; the spirals are numerous, closely-packed, grained, unequal threads extending from the suture to the base; on the upper whorl two spirals predominate to form a double keel, but these gradually decrease, so that when the last whorl is reached the discrepancy between major and minor spirals has nearly disappeared. Aperture:—Mouth narrow, the varix equal to the preceding ribs, and not rising above the plane of the suture; its outer limb evenly striated; within the aperture a tubercle arises beneath the sinus; below that and under the free edge of the limb are four minute denticles; columella perpendicular; sinus small and shallow; canal short and open. Length 5.5 mm., breadth 2 mm.

This is like a miniature *Mangilia multigranosa* Schepman.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self). The "Chevert" also collected this at Katow, Papua.

PSEUDORHAPHITOMA DARNLEYI *Brazier*.

(Plate li., fig. 134.)

*Clathurella darnleyi* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 154.*Mangelia darnleyensis* Tryon, Man. Conch., vi., 1884, p. 256, pl. i., fig. 73.

One of the original Darnley Island specimens is here figured. The species has the usual contour of *Pseudorhaphitoma*, but differs by the absence of fine grained spirals. This, with *P. ditylota*, *fortilicata*, and *styracina*, are aberrant members of this genus whose classification requires further attention.

*Hab.* Queensland:—20 fathoms, off Darnley Island (type, Brazier); Murray Island (self).

PSEUDORHAPHITOMA DITYLOTA *Melville*.*Clathurella ditylota* Melville, Proc. Malac. Soc., x., 1912, p. 252, pl. xii., fig. 17.*Liccardia ditylota* Melville, *op. cit.*, xii., 1917, p. 183.

*Hab.* Queensland:—Townsville (Henn).

PSEUDORHAPHITOMA INFORMIS *sp. nov.*

(Plate li., fig. 135.)

Shell small, rather solid, ovate-elongate, broader and shorter than usual. Colour uniform pale buff externally, stained with orange inside the aperture. Whorls six. Sculpture:—The ribs are six to a whorl, continuous, rather low, round-backed, and perpendicular; the spirals are fine, even, and close threads, which become coarser and more widely spaced on the snout. Aperture:—Mouth rather wide; varix the same calibre as the ribs; sinus small and shallow; within the outer lip are four small denticles, the uppermost largest; canal short, broad, and re-curved. Length 5 mm., breadth 2 mm.

*Hab.* N.S.Wales:—Broughton Island, Port Stephens (Museum Exped.) Queensland:—17 to 20 fathoms, Mast Head Island (self).

PSEUDORHAPHITOMA PYRAMIS *Hinds*.*Clacatula pyramis* Hinds, Proc. Zool. Soc., 1843, p. 42, and Zool. "Sulphur," ii., 1844, p. 20, pl. vi., fig. 19.*Mangelia obeliscus* Reeve, Proc. Zool. Soc., 1846, p. 110, and Conch. Icon., iii., 1846, pl. vii., fig. 56.

*Clathurella (Pseudorhaphitoma) obeliscus* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 56 (not *Pleurotoma obeliscus* Des Montins, Linn. Soc. Bordeaux, 1842, p. 70).

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (self).



*PSEUDORHAPHITOMA STYRACINA* *sp. nov.*

(Plate lii., fig. 136.)

Shell solid, subulate. Whorls ten. Colour uniform grey. Sculpture:—Ribs low and broad, with narrow interstices, six on the last whorl; spirals are sharp threads running evenly over both ribs and furrows, and increasing by intercalation; on the penultimate are four spirals, and on the last whorl fourteen, some of which are alternately large and small. Aperture:—Sinus U-shaped, rather wide and deep; columella simple; outer lip a thin bent edge; throat grooved within. Length 10 mm., breadth 3 mm.

This has a general likeness to *Pleurotoma fortilirata* Smith,<sup>84</sup> but has the base less excavate, the spirals more numerous, and the radials fewer and bolder.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); off Horsey River (self); 10 fathoms, Cape Sidmouth (Henn). There are unrecorded specimens of this in the "Chevert" collection from off Cape York and Katow.

*PSEUDORHAPHITOMA TRANSITANS* *sp. nov.*

(Plate lii., fig. 137.)

Shell small, solid, biconical. Colour uniform pale buff. Whorls seven. Protoconch of two small smooth helicoid whorls. Sculpture:—First adult whorl with numerous small radial riblets; on subsequent whorls the ribs are spaced seven to a whorl; they are continuous, perpendicular, and elevated; the spirals are prominent cords which project at the intersection of the ribs, two on the upper whorls and twelve on the last one, evenly distributed from the shoulder to the anterior extremity. Aperture:—Mouth narrow; varix broad and high, of the same calibre as the ribs; sinus small and shallow; within the aperture is a small denticule at each side of the sinus, and a small deeply-seated fold on the columella; canal short and wide. Length 4 mm., breadth 1.5 mm.

In general appearance, by short stature and conspicuous spirals, this form recedes from typical *Pseudorhaphitoma* towards *Heterocithara*.

*Hab.* Queensland:—15 fathoms, Palm Islands (self).

*GURALEUS* *Hedley.*

*Guraleus* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M. 79, type *Mangelia picta* Adams and Angus.

Shell fusiform or subcylindrical, thin. Colour ranging from uniform buff, with or without chocolate spiral lines or bands, to entire chocolate. Nucleus of two or three smooth helicoid whorls. Fasciole not interrupting the sculpture, and scarcely indicated by the curvature of growth lines.

<sup>84</sup> Smith—Proc. Zool. Soc., 1879, p. 194, pl. xix., fig. 22.

**Sculpture:**—The radials vary from bold spaced ribs projecting at the shoulder to fine close riblets; the entire shell, except the nucleus, is over-run with fine, close, beaded or unbeaded threads. Aperture about half the length of the shell, with or without armature; outer lip slightly inflected; sinus subsutural, deeply rounded; canal short and open.

*Guraleus* is perhaps a development in temperate seas of a tropical citharoid stock in which less favourable growth conditions have effected structural economies, by reduction of the varix, the teeth within the aperture, granular microscopic sculpture, and a looser winding of the whorls. *Mangilia glabra* Harris and *M. obsoleta* Harris, from the miocene of Victoria, appears to be *Guraleus*. *Mangilia sinclairi* Smith represents this genus in New Zealand. South Africa has at least one representative of *Guraleus* in *Clathurella amplexa* Gould.<sup>85</sup>

A division of *Guraleus* may be separated from the rest by rounded shoulder, ovate contour, shorter spire, and smoother sculpture. It includes *bellus*, *comptus*, *costatus*, *fallaciosus*, *glacridus*, *insculptus*, *inornatus*, *kingensis*, *mitralis*, *nitidus*, *permutatus*, and *schoutenensis*. This may be distinguished as a subgenus *Marita*, with *Cythura compta* Adams and Angus for type.

#### GURALEUS BELLUS Adams and Angus.

*Cithara bella* Adams and Angus, Proc. Zool. Soc., 1863 (1864), p. 419, pl. xxxvii., fig. 6. *Id.* Angus, Proc. Zool. Soc., 1865, p. 160.

*Mangelia boukei* Tryon, Man. Conch., vi., 1884, p. 270, pl. xxv., fig. 36.

*Mangilia adcocki* Sowerby, Proc. Malac. Soc., ii., 1896, p. 29, pl. iii., fig. 18. *Id.* Pritchard and Gatliff, Proc. Roy. Soc., xii., 1900, p. 174. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 312.

In the British Museum there is one shell marked as the type of *G. bella*. Sowerby changed the name of this species on the ground that *Mangilia bella* was preoccupied by Hinds, but as a matter of fact *Mangilia* was used for this species neither by Hinds nor by Adams and Angus, so that the innovation was not necessary. Tryon erred in ascribing this species to Ceylon.

**Hab.** South Australia:—Rapid Bay (type, Angus); 14 to 22 fathoms, Investigator Strait (Verco). Victoria:—Port Phillip, Western Port, and Puebla (Gatliff). Tasmania:—North Coast (May).

#### GURALEUS BRAZIERI Angus.

(Plate lii., fig. 138.)

*Clathurella brazieri* Angus, Proc. Zool. Soc., 1871, pp. 18, 93, pl. i., fig. 21.

*Id.* Tryon, Man. Conch., vi., 1884, p. 295, pl. xvii., fig. 98 (not

<sup>85</sup> Bartsch—U.S. Nat. Museum, Bull. 91, 1915, p. 30, pl. ii., fig. 10.

*Daphuella brazieri* Hedley, Mem. Austr. Mus., iv., 1903, p. 392, text fig. 107).

In the British Museum is one marked type and included in *Mangelia*.

*Hab.* N.S.Wales:—Sow and Pigs Reef, Port Jackson (type, Brazier); 5 fathoms, Wreck Bay (self). Victoria:—Port Albert (Gabriel).

GURALEUS COMPTUS *Adams and Angus.*

(Plate liii., fig. 139.)

*Cithara compta* Adams and Angus, Proc. Zool. Soc., 1863 (1864), p. 419, pl. xxxvii., fig. 5. *Id.* Angus, Proc. Zool. Soc., 1865, p. 160, 1867, p. 204. *Id.* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 18. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 176. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 327. *Id.* Hedley, Proc. Roy. Soc. W.A., i., 1916, p. 206.

*Daphuella varia* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 138, and 1877 (1878), p. 27. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 73.

*Clathurella peregrina* Gould, Proc. Bost. Soc. Nat. Hist., vii., Oct. 1860, p. 337. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 311.

In the British Museum four specimens are marked as types of this species.

*Hab.* N.S.Wales:—Port Jackson (type of *compta*, Angus); Catherine Hill Bay (Cherry). Victoria:—King Island (Tate); Flinders; San Remo; Sorrento (Gatliff). Tasmania:—Tamar Heads (type of *D. varia*, Tenison-Woods). South Australia:—Rapid Bay (Angus); St. Francis Island; 9 to 20 fathoms, St. Vincent and Spencer Gulfs (Verco). Western Australia:—Rottnest Island (Verco); Cottesloe (Henn).

GURALEUS COSTATUS *sp. nov.*

(Plate lii., fig. 140.)

Shell small, thin, elongate-ovate. Colour pale cream, with one or two faint and narrow buff zones. Whorls six, of which two form the protoconch; upper whorls glossy. Sculpture:—The radials are narrow, sharp, elevated riblets, becoming closer and smaller as growth proceeds, and vanishing on the base; the first adult whorl has sixteen riblets, which increase to about twenty-seven on the last whorl; the base has about ten incised spiral lines. Aperture:—The mouth is wide, lip thin, not inflected, with a wide and shallow sinus. Length 10 mm., breadth 3 mm.

*Hab.* N.S. Wales:—80 fathoms, 22 miles east of Narrabeen (type, self).

Var. *WILESIANUS*, *var. nov.*

More slender in contour, and developing spiral striae on the intercostal spaces of the upper whorls.

*Hab.* South Australia:—100 fathoms, 40 miles south of Cape Wiles (self).

*GURALEUS CUSPIS* Sowerby.

*Mangelia cuspis* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31, pl. iii., fig. 17.

*Clathurella letourneauiana* var. *cuspis* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 309.

*Hab.* South Australia:—St. Vincent Gulf (type, Verco). Victoria:—Dromana (Gabriel).

*CUSPIS* var. *CONNECTENS* Sowerby.

*Mangelia connectens* Sowerby, Proc. Malac. Soc., ii., 1896, p. 30, pl. iii., fig. 14. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 316.

*Hab.* South Australia:—20 fathoms, St. Vincent Gulf (type); 55 fathoms, Cape Borda; 15 fathoms, St. Francis Island (Verco). Tasmania:—Derwent Estuary (May).

*GURALEUS FASCINUS* *sp. nov.*

(Plate lii., fig. 141.)

Shell elongate-fusiform; the last whorl about half of total length; whorls angled at the shoulder. Colour:—The type is cream-buff monochrome; another specimen is brown-buff, with a pale band on the base, and another on the anterior extremity, and with every fourth spiral paler than the rest; another specimen is white, with an orange-brown zone on the base. Whorls eight, including a three-whorled protoconch; sutures linear. Sculpture:—Conspicuous ribs descend continuously from whorl to whorl at the rate of twelve to the penultimate; on the last whorl the ribs become gradually smaller, and vanish on the base; the whole surface is over-run by minute, closely-packed, even, sharp spiral threads. Aperture:—Mouth rather wide; outer lip with a low varix and a thin expanded free edge, which is insinuate at the base; canal short; sinus wide and shallow. Length 9 mm., breadth 4 mm.

*Hab.* N. S. Wales:—Port Jackson (type, self); 18 fathoms, between Balls Head and Goat Island, Port Jackson (Brazier).

*GURALEUS FASCINUS* var. *STEPHENENSIS* *var. nov.*

(Plate lii., fig. 142.)

Larger than the type, with fewer radials, and orange on the base.

*Hab.* N.S.Wales:—Port Stephens (Brazier).

GURALEUS FALLACIOSUS *Sowerby*.

*Daphnella fallaciosa* Sowerby, Proc. Malac. Soc., ii., 1896, p. 26, pl. iii., fig. 7.

*Mangilia fallaciosa* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 319. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxiii., 1910, p. 90. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308.

*Hab.* South Australia:—St. Vincent Gulf (type); 150 fathoms, Beachport; 300 fathoms, Cape Jaffa; 20 fathoms, St. Francis Island (Vervo). Victoria:—Wilson's Promontory ("Endeavour"). Tasmania:—100 fathoms, Cape Pillar (May).

GURALEUS FLACCIDUS *Pritchard and Gatliff*.

(Plate lii., fig. 143.)

*Mangilia flaccida* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 102, pl. viii., figs. 3, 4. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1900, p. 370. *Id.* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 315.

*Hab.* Victoria:—Western Port (type, Pritchard and Gatliff). Tasmania (May). South Australia:—St. Francis Island; 55 fathoms, Cape Borda; St. Vincent Gulf (Vervo).

GURALEUS FLAVESCENS *Angas*.

(Plate lii., fig. 144.)

*Mangilia flavescens* Angas, Proc. Zool. Soc., 1877, p. 37, pl. v., fig. 11.

In the British Museum are two marked as types of this species.

*Hab.* N. S. Wales:—Port Jackson (type, Brazier); Port Stephens (Museum Expedition).

GURALEUS GRANULOSISSIMUS *Tenison-Woods*.

*Clathurella granulosisissima* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 37. *Id.* Tryon, Man. Conch., vi., 1884, p. 282, pl. xxxii., fig. 20. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370, pl. xxiv., fig. 34. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 66.

*Mangilia granulosisissima* Hedley, Mem. Austr. Mus., iv., 1903, p. 393. *Id.* Gatliff, Proc. Roy. Soc. Vict., xx., 1907, p. 32.

In this species, as in *tenuiliratus* and *morologus*, grains are strung on spirals, but here the grains are of much larger size. Sometimes the radials tend to disappear.

*Hab.* Tasmania:—North Tasmania (type, Atkinson); D'Entrecasteaux Channel (May). Victoria:—6 to 8 fathoms, Western Port (Gatliff). N. S. Wales:—22 fathoms, off Manning River; 63 to 75 fathoms, Port Kembla ("Thetis").

GURALEUS INCRUSTUS *Tenison-Woods.*

- Drillia incrusta* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 136.  
*Clathurella incrusta* Tryon, Man. Conch., vi., 1884, p. 286, pl. xxxiv., fig. 99.  
*Mangelia st. gallæ* and var. *benedicti* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 137. *Id.* Hardy, *op. cit.*, 1915, p. 69. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369, pl. xxiv., fig. 33. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 50.  
*Clathurella st. gallæ* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 310.

Mr. W. L. May wrote to me (9th June, 1916) that the two type specimens of *D. incrusta* in the Tasmanian Museum are poorly preserved, but seem to him identical with the type of *st. gallæ*, which is a good specimen, and in the same collection.

The identity of var. *benedicti* seems to be lost: it was probably a distinct species.

*P. incrusta* closely resembles *P. tenuilirata*, but *incrusta* has more numerous less prominent radials, but fewer major spirals. *P. tenuilirata* is the broader in proportion to length, and has the minute spirals more distinctly grained.

*Hab.* Tasmania:—Blackman's Bay (type of *incrusta*, Petterd); Long Bay (type of *st. gallæ*, Atkinson). Victoria:—Western Port (Pritchard and Gatliff). South Australia:—40 to 150 fathoms, Beachport; 130 fathoms, Cape Jaffa (Verco).

GURALEUS INORNATUS *Sowerby.*

- Mangelia inornata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 30, pl. iii., fig. 15.  
*Daphnella inornata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 321.

*Hab.* South Australia:—15 to 20 fathoms, St. Vincent Gulf (type); 22 fathoms, Backstairs Passage; 62 fathoms, Cape Borda; 90 fathoms, Cape Jaffa; 110 fathoms, Beachport (Verco).

GURALEUS INSCULPTUS *Adams and Angus.*

- Mangelia insculpta* Adams and Angus, Proc. Zool. Soc., 1863 (1864), p. 420, pl. xxxvii., fig. 8. *Id.* Angus, Proc. Zool. Soc., 1865, p. 160. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 30. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 315. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxiii., 1910, p. 90.  
*Clathurella insculpta* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 57. *Id.* Hidalgo, Revist. Acad. Cienc. Madrid, i., 1904, p. 341.

In the British Museum there is one marked type. Probably Dr. Boettger was wrong in identifying this species from Manilla.

*Hab.* South Australia:—St. Vincent Gulf (type, Angus); Investigator Strait; 12 fathoms, Cape Borda; Sceale Bay; St. Francis Island (Verco). Victoria:—Port Albert (Worcester).

Var. *DELICATULUS Tenison-Woods.*

*Mangelia delicatula* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 37. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369, pl. xxiv., fig. 35. *Id.* Gatliff, Proc. Roy. Soc. Vict., xx., 1907, p. 31. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 316. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 65.

*Daphnella delicatula* Tryon, Man. Conch., vi., 1884, p. 302, pl. xxxii., fig. 29.

*Hab.* Tasmania:—Long Bay (type, Tenison-Woods); D'Entrecasteaux Channel (May). Victoria:—8 fathoms, Western Port (Gatliff). South Australia:—Aldinga; St. Francis Island (Verco).

*GURALEUS KINGENSIS Petterd.*

*Daphnella kingensis* Petterd, Journ. of Conch., ii., 1879, p. 102. *Id.* Hedley and May, Rec. Austr. Mus., vii., 1908, p. 112.

*Cythara kingensis* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 50. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 327.

*Cythara cognata* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1899, p. 103, pl. viii., fig. 5.

*Hab.* Tasmania:—King Island (type of *kingensis*, Petterd); Frederick Henry Bay (May). Victoria:—Western Port (type of *cognata*, Gabriel). South Australia:—15 to 20 fathoms, St. Francis Island; 40 to 110 fathoms, Beachport; 90 to 300 fathoms, Cape Jaffa (Verco).

Var. *EMINA Hedley.*

(Figure 8.)

*Mangelia emina* Hedley, Rec. Austr. Mus., vi., 1905, p. 53, fig. 20.

In this variety the shell is more fusiform, the ribs more prominent and numerous, and the spirals wider spaced.

*Hab.* N. S. Wales:—100 fathoms, east of Cape Byron (type, Halligan); 63 to 75 fathoms, Port Kembla ("Thetis").



Fig. 8.

*GURALEUS LALLEMANTIANUS Crosse and Fischer*

*Pleurotoma (Mangelia) lallemantiana* Crosse and Fischer, Journ. de Conch., xiii., 1865, p. 423, pl. xi., fig. 5.

*Clathurella lallemantiana* Angas, Proc. Zool. Soc., 1865, p. 160. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 28. *Id.* Pritchard and

Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 177. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 371. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 309.

*Mangilia lallemantiana* Angas, Proc. Zool. Soc., 1877, p. 185.

Angas seems to have erred in citing this from Port Jackson. The type of *G. lallemantiana*, so marked, is in the British Museum.

*Hab.* South Australia:—Rapid Bay (type, Angas). Tasmania:—Bass Straits (May). Victoria:—Port Phillip; Western Port (Pritchard and Gatliff).

*GURALEUS LETOURNEUXIANUS* Crosse and Fischer.

(Plate lii., fig. 145.)

*Plenrotoma (Clathurella) letourneuxiana* Crosse and Fischer, Journ. de Conch., xiii., 1865, p. 425, pl. xi., fig. 7.

*Mangilia letourneuxiana* Angas, Proc. Zool. Soc., 1867, p. 204. *Id.* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 28. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 32.

*Daphnella letourneuxiana* Hutton, Cat. Mar. Moll. N.Z., 1873, p. 12, and 1880, p. 218.

*Clathurella letourneuxiana* Tryon, Man. Conch., vi., 1884, p. 286, pl. xvii., fig. 87. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 177. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 177. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 309.

As the original illustration is unsatisfactory, another figure is here offered. The species has been reported, apparently on insufficient evidence, from New Zealand and from South Australia.

*Hab.* N. S. Wales:—Port Jackson (type, Angas); Port Stephens (Brazier). Tasmania:—Frederick Henry Bay (May). Victoria:—Port Phillip; Western Port (Pritchard and Gatliff).

*GURALEUS MITRALIS* Adams and Angas.

*Bela mitralis* Adams and Angas, Proc. Zool. Soc., 1863 (1864), p. 420. *Id.* Angas, Proc. Zool. Soc., 1867, p. 202. *Id.* Tenison-Woods, Proc. Roy. Soc. Tasm., 1877, p. 27.

*Daphnella mitralis* Brazier, Journ. of Conch., vi., 1889, p. 71.

*Mangilia mitralis* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 173. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 311. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 310, pl. xix., fig. 75.

*G. mitralis* can be distinguished from its variety *australis* by longer and more slender form, by finer sculpture, by a subsutural band of raw sienna, and by the geographical distribution.



*Hab.* N. S. Wales:—Port Jackson (type, Angas); Port Stephens; Middle Harbour (Brazier); Dudley; Twofold Bay (self). Victoria:—(Pritchard and Gatliff).

VAR. AUSTRALIS *Adams and Angas.*

*Bela australis* Adams and Angas, Proc. Zool. Soc., 1863 (1864), p. 420.  
*Id.* Angas, Proc. Zool. Soc., 1865, p. 159.

*Mungilia australis* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxviii., 1913, p. 310, pl. xix., fig. 76. *Id.* Hedley, Journ. Roy. Soc., W.A., i., 1916, p. 207.

The type of *australis*, figured as above, is in the British Museum.

*Hab.* South Australia:—Aldinga Bay (type of *australis*); Rapid Bay (Angas); Kangaroo Island; Venus Bay; St. Francis Island (Verco). Tasmania:—King Island (Tate). Western Australia:—Cottesloe (Henn).

GURALEUS MOROLOGUS *sp. nov.*

(Plate lii., fig. 146.)

*Daphnella brazieri* Hedley, Mem. Austr. Mus., iv., 1903, p. 392, fig. 107 (not *Clathurella brazieri* Angas).

Shell thin, slender-fusiform, sub-turreted, upper whorls with a sloping shoulder meeting a perpendicular periphery at an acute angle. The radials are prominent spaced ribs, nine to twelve on the last whorl, finally evanescent, acutely prominent on the shoulder, and diminishing in a backward curve to the suture. The spirals are of two grades; first spaced cords that over-ride the ribs and lattice their interstices; these vary in size and number, about twenty may occupy the last whorl; between these cords are packed from three to ten minute threads; these small spirals cover the whole surface of the shell, and resolve under the lens into strings of small and close grains. Aperture:—Mouth narrow; columella straight; lip simple, sharp, and produced; sinus broad and shallow. Length 8 mm., breadth 3 mm.

At first acquaintance I mistook this for *G. brazieri*, which is more cylindrical, and has more and slighter radials. Superficially it resembles *G. connectens*, but microscopically the fine spirals of *morologus* are seen to carry grains not apparent in *connectens*. The protoconch of *morologus* is also more bulbous than that of *connectens*.

*Hab.* N. S. Wales:—50 to 52 fathoms, off Botany Heads (type); 22 fathoms, off Manning River; 41 to 50 fathoms, Cape Three Points; 63 to 75 fathoms, Port Kembla ("Thetis" Expedition). Victoria:—Western Port (Gabriel).

*GURALEUS NITIDUS* *sp. nov.*

(Plate lii., fig. 147.)

Shell small, thin, translucent, glossy, narrow-ovate. Colour white, with a few faint rusty spots. Whorls five and a half, two of which compose the protoconch. Sculpture:—Radials are elevate narrow spaced ribs—on the first adult whorl eleven, on the last whorl eight; between these ribs are incised spiral lines, increasing from six on the first adult whorl to about twenty-four on the last. Aperture:—Mouth narrow; varix slight; sinus indefinite. Length 7.5 mm., breadth 3 mm.

*Hab.* South Australia:—100 fathoms, 40 miles south of Cape Wiles (type, self).

*GURALEUS PERMUTATUS* *sp. nov.*

(Plate liii., fig. 148.)

Shell small, ovate-cylindrical, rather gibbous. Colour white on the protoconch, and pale cream on the remainder of the shell. Whorls five, of which two compose a rather elevate protoconch. Sculpture:—On the first adult whorl are ten narrow, elevated, wide-spaced radials; these degenerate as growth advances; from the last suture they persist as downward dashes, and vanish on the anterior half of the shell; the entire surface carries dense microscopic spiral scratches. Aperture:—The mouth is narrow and vertical; the varix is prominent and expanded; near the summit is excavated a broad and shallow sinus, and at two-thirds of its length occurs a stromboid insinuation; a thin free edge reaches over the mouth; on the columella is a substantial callus; canal short, wide, and open. Length 5.7 mm., breadth 2.5 mm.

*Hab.* N. S. Wales:—63 to 75 fathoms, off Port Kembla (type, "Thetis"); 100 fathoms, Wollongong (self).

*GURALEUS PICTUS* *Adams and Angas.*

(Plate liii., fig. 150.)

*Mangelia picta* Adams and Angas, Proc. Zool. Soc., 1863 (1864), p. 419, pl. xxxvii., fig. 7. *Id.* Angas, *op. cit.*, 1867, p. 204. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 29. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 173. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 315.

*Mangelia meredithii* Tenison-Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 142. *Id.* May, Proc. Roy. Soc. Tasm., 1902, p. 110. *Id.* Hardy, *op. cit.*, 1915, p. 68.

*Hab.* N.S.Wales:—Port Jackson (type of *pictus*, Angas); Dudley; Gerrington (Hedley). Queensland:—Caloundra (Kesteven and Johnston); Bustard Head (Pulleine); Lady Elliot Island (Miss Lovell). Victoria (Pritchard and Gatliff). Tasmania:—Bass Straits (type of *meredithii*, Tenison-Woods); King Island (Tate). South Australia:—8 to 200 fathoms, St. Vincent Gulf to Fowler's Bay (Verco). Western Australia:—Geographe Bay (Cox).

VAR. *VINCENTINUS* Crosse and Fischer.

(Plate liii., fig. 149.)

*Pleurotoma (Mangelia) vincentina* Crosse and Fischer, Journ. de Conch., xiii., 1865, p. 422, pl. xi., fig. 6.

*Mangelia vincentina* Angas, Proc. Zool. Soc., 1865, p. 160, and 1877, p. 185. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 30. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 174. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 316.

*Daphnella vincentina* Tryon, Man. Conch., vi., 1884, p. 311, pl. xvi., fig. 91. *Id.* Cooke, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 35.

*Mangelia alucinans* Sowerby, Proc. Malac. Soc., ii., 1896, p. 29, pl. iii., fig. 12, and var. *ornata*, pl. iii., fig. 13. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 175. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369.

*Mangelia lineata* Angas (not Reeve), Proc. Zool. Soc., 1865, p. 160.

*Clathurella browniana* (Tenison-Woods) Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 445.

*Hab.* South Australia:—Rapid Bay (type of *vincentina*, Angas); Yankalilla Bay (type of *alucinans*); St. Francis Island; 110 fathoms, Beachport (Verco). Victoria:—Port Phillip; Western Port; Portland (Pritchard and Gatliff). Tasmania:—Long Bay (May); King Island (Tate). N. S. Wales:—Cabbage Tree Bay; 20 fathoms, Port Jackson Heads (Brazier); Twofold Bay (self). Western Australia:—King Georges Sound (Dakin).

It is improbable that Cooke was correct in identifying this from the Gulf of Suez.

This is one of the most wide-spread and variable of Australian marine temperate gasteropods. Typically *G. pictus* is an elongate round-shouldered shell, 11·5 mm. long and 3·5 mm. broad. Colour white, with a broad band, liable to splitting and paler at the edges, of sienna brown, which extends from the angle down to the suture; also a narrow spiral brown thread above the angle. The ribs are eight to a whorl, distant, oblique, continuous above, and gradually fading out on the base of the last whorl. To the unaided eye the surface is smooth and glossy, but under the microscope appear narrow, sharply incised, spiral grooves, faint above, and gradually becoming more distinct on the base; of these there are thirty on the last whorl.

More common is the form called *meredithiae* by Tenison-Woods. This is comparatively broader, more acutely angled at the shoulder, 9·5 mm. long, and 4 mm. broad. Colour pale cream, with brown dashes in the intercostal spaces on the shoulder. The ribs are more prominent, and vary from nine to twelve on a whorl. The spiral striae multiply by intercalation to about sixty on the last whorl. A colour variety, with several narrow spiral brown bands, has been figured by Sowerby as *ornata*.

The variety *vincentina* is a small, compact, and monochrome brown form of the Adelaidean region, the relations, variability, and range of which have been excellently discussed by Sir Joseph Verco.

In the British Museum are two marked as types of *M. picta*, and one (perforated in the penultimate whorl) marked as type of *vincentina*. Mr. Hardy recorded that the type of *meredithiae* is still preserved in the Tasmanian Museum, Hobart.

GURALEUS SCHOUTENENSIS May.

*Mangilia schoutenensis* May, Proc. Roy. Soc. Tasm., 1901, p. 393, pl. xv., fig. 19.

*Hab.* Tasmania:—40 fathoms, 3 miles east of Schouten Island (type, May). Victoria:—80 fathoms, off Gabo Island ("Endeavour"). N. S. Wales:—63 to 75 fathoms, Port Kembla; 22 to 39 fathoms, Port Hacking ("Thetis"); off Cabbage Tree Island; Port Stephens (Museum Expedition).

GURALEUS TASMANICUS Tenison-Woods.

(Plate liii., fig. 151.)

*Cythara tasmanica* Tenison-Woods, Proc. Roy. Soc. Tasm., 1875 (1876), p. 145. *Id.* Hardy, *op. cit.*, 1915, p. 70. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxvi., 1902, p. 700.

*Mangilia tasmanica* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 175. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 311.

*Mangilia jacksonensis* Angas, Proc. Zool. Soc., 1877, p. 37, pl. v., fig. 10.

*Daphnella jacksonensis* Brazier, Journ. of Conch., vi., 1889, p. 71.

*Mangilia alternata* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 39. *Id.* Hardy, *op. cit.*, 1915, p. 62. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 173. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369, text fig. 4.

*Cythara maccayi* Petterd, Journ. of Conch., ii., 1879, p. 103.

The type of *tasmanica* is in the Tasmanian Museum, and that of *jacksonensis* is in the British Museum. Possession of the type of *M. alternata* is claimed by Pritchard and Gatliff for the National Museum, Melbourne; they assign it to *mitralis*. But Hardy records the type of *alternata* as being in the Tasmanian Museum, and accepting this as being more probable, I have followed Tate and May in grouping *alternata* with *tasmanica*. The Port Jackson expression (var. *jacksonensis*) of this species is here figured.

*Hab.* Tasmania:—East Tasmania (type of *tasmanica*, Tenison-Woods): Frederick Henry Bay (May); Circular Head (type of *alternata*, Atkinson); Brown's River (type of *maccayi*, Petterd). South Australia:—14 to 18 fathoms, St. Vincent Gulf; Spencer's Gulf (Verco). Victoria:—Port Fairy (Whan). N. S. Wales:—25 fathoms, off Port Jackson Heads (? "Challenger"); Middle Harbour (Brazier); Dudley; Ballina (self).

*GURALEUS TENNILIRATUS* Angas.

(Plate liii., fig. 152.)

*Clathurella tenuilirata* Angas, Proc. Zool. Soc., 1871, p. 17, pl. i., fig. 18.*Id.* Melvill and Standen, Proc. Zool. Soc., 1901, p. 445. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 188.*Defrancia tenuilirata* Cooke, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 36.*Mangelia tenuilirata* Hedley, Mem. Austr. Mus., iv., 1903, p. 392.

This species has a sculpture of minute grained threads. In the British Museum is a single specimen presented by Angas, evidently the type, but not so marked. The references of this species to the Gulf of Oman and to the Gulf of Suez need confirmation.

*Hab.* N. S. Wales:—5 fathoms, Goat Island, Port Jackson (type); Port Stephens (Brazier); 41 to 50 fathoms, Cape Three Points; 63 to 75 fathoms, Port Kembla ("Thetis").

*MACTEOLA* Hedley.*Macteola* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M. 79.

This name is proposed for a genus of the *Mangiliinae*, in which the aperture has not acquired armature, and in which the lip is not flexed. Prominent radial ribs are over-ridden by fine beaded spiral threads. The apex is mucronate, with smooth whorls. Characteristic is a colour scheme of a peripheral zone of brown or black or orange, sometimes broken into a series of dots or dashes. Type *Purpura (Uronia) anomala* Angas.

Besides the Australian species here enumerated, an extra-limital species, *Mangilia thiasotes* Melvill and Standen, may also be included in *Macteola*.

*MACTEOLA ANOMALA* Angas.

(Plate liii., figs. 153, 154, 155.)

*Purpura (Uronia) anomala* Angas, Proc. Zool. Soc., 1877, pp. 34, 180, pl. v., fig. 1, and 1880, p. 415.*Murex anomala* Tryon, Man. Conch., ii., 1880, p. 180, pl. xxxvi., fig. 422, and vi., 1884, p. 318.

*Mangelia anomala* Tate, Proc. Linn. Soc. N.S.W., v., 1880, p. 131. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 31. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 174. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 369. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 319. *Id.* Hedley, Proc. Roy. Soc. W.A., i., 1916, p. 206.

In fresh specimens a delicate grain sculpture is visible under the lens. The colour varies. There may be only a peripheral row of separate intercostal brown spots, or beneath these there may run a continuous orange zone, anterior to which the shell may be faintly suffused with pink.

*Hab.* N. S. Wales:—25 fathoms, off Port Jackson Heads (Brazier). The species ranges from New South Wales south and west through Victoria, Tasmania, and South Australia to Western Australia. The extreme stations known to me are Port Stephens on the east and Cottesloe on the west.

MACTEOLA INTERRUPTA *Reeve*.

*Mangelia interrupta* Reeve, Conch. Icon., iii., 1846, pl. iii., fig. 16, and Proc. Zool. Soc., 1846, p. 61. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 399. *Id.* Bouge and Dautzenberg, Journ. of Conch., lxi., 1913 (1914), p. 151.

*Hab.* Queensland:—Rocky Isle, off Cape Flattery (self).

MACTEOLA SEGESTA *Chenu*, var. *CINCTURA* *car. nov.*

(Plate liii., fig. 156.)

*Columbella segesta* Chenu, Illustr. Conch., 1850, pl. xxvii., figs. 5, 6. *Id.* Kobelt, Conch. Cab., 1896, p. 321, pl. xliii., fig. 10.

*Daphnella bella* Pease, Proc. Zool. Soc., 1860, p. 147. *Id.* Martens and Langkavel, Donum Bismarck., 1871, p. 1, pl. i., fig. 4.

*Mangelia bella* Melvill and Standen, Journ. of Conch., viii., 1897, p. 98. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 146. *Id.* Oliver, Trans. N.Z. Inst., xlvii., 1914 (1915), p. 537.

*Pleurotoma gemmulata* Deshayes, Moll. de Réunion, 1863, p. 107, pl. xii., figs. 8-10. *Id.* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xlv., 1875, p. 86.

An Australian form, var. *cinctura*, seems separable by its rather more prominent ribs, and by a girdle of solid black which replaces the usual zone of short broken spiral lines.

*Hab.* Queensland:—Rocky Isle (type of *cinctura*): Two Isles, off Cape Flattery: Lizard Island (self).

MACTEOLA THESKELA *Melvill and Standen*.

*Mangelia (Glyphostoma) theskela* Melvill and Standen, Journ. of Conch., viii., 1895, p. 97, pl. iii., fig. 25 (not 26), and 1897, p. 451, pl. xi., fig. 81. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 156. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 178.

*Hab.* Queensland:—Rocky Isle, off Cape Flattery (self).

Sub-family DAPHNELLINÆ.

DAPHNELLA *Hinds*.

*Daphnella* Hinds, Zool. Voy. "Sulphur," 1844, p. 25. *Id.* Herrmannsen, Index Gen. Moll., i., 1846, appointing type *D. lyneceiformis* Kiener.

This genus is well characterised by a thin shell, elongate-ovate form, sharp outer lip, position of the sinns on the line of the advancing suture, and by the reduction of the canal.

The species recorded by Brazier<sup>86</sup> as *Daphnella subula* proves to be *Hemidaphne axis*, and his *D. pluricarinata* is here introduced as *D. cheverti*.

An Australian Tertiary fossil, described by Tenison-Woods as *Daphnella gracillima*, was by Harris<sup>87</sup> created the type of a new genus *Telechilus*. Probably it does not belong to this family.

#### DAPHNELLA ACULEOLA Hedley.

*Daphnella aculeola* Hedley, Proc. Linn. Soc. N.S.W., xxxix., 1915, p. 728, pl. lxxxii., fig. 58.

*Hab.* N. S. Wales:—Port Jackson (type, self).

#### DAPHNELLA ARAFURENSIS Smith.

*Pleurotoma (Daphnella) arafurensis* Smith, Zool. Coll. "Alert," 1884, p. 40, pl. iv., fig. G.

*Hab.* Queensland:—32 to 36 fathoms, Arafura Sea (type, Coppinger); 12 fathoms, Torres Straits (Brazier); 4 to 14 fathoms, Albany Pass (self).

#### DAPHNELLA AULACOESSA Watson.

*Clathrella (Daphnella) aulacoessa* Watson, Journ. Linn. Soc., Zool., xv., 1881, p. 472. *Id.* Chall. Rep. Zool., xv., 1886, p. 367, pl. xxiii., fig. 9.

*Hab.* Queensland:—28 fathoms, west of Cape York (type, "Challenger"); 10 fathoms, Mapoon; 4 to 14 fathoms, Albany Passage; 5 to 10 fathoms, Palm Island; 5 to 10 fathoms, Hope Island (self).

#### DAPHNELLA BOHOLENSIS Reeve.

*Pleurotoma boholeensis* Reeve, Conch. Icon., i., 1843, pl. 13, fig. 112.

*Daphnella boholeensis* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 60. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 403. *Id.* Couturier, Journ. de Conch., lv., 1907, p. 130. *Id.* Bonge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 208.

With doubt a single specimen of a species not hitherto recognised as Australian is thus recorded.

*Hab.* N. S. Wales:—Norah Head (Coll. W. H. Hargraves).

<sup>86</sup> Brazier—Proc. Linn. Soc. N.S.W., i., 1876, p. 158.

<sup>87</sup> Harris—Brit. Mus. Cat. Austr. Tert. Moll., 1897, p. 64.

## DAPHNELLA BOTANICA Hedley.

(Plate liii., figs. 157, 158, 159.)

*Daphnella botanica* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M. 83.

The first record of *Daphnella* from Australia was by G. F. Angas, who in 1867 reported *D. crebriplicata* Reeve and *D. lynceiformis* (sic) Kiener from Sydney, and in 1880 *D. fragilis* Reeve from Aldinga Bay, South Australia.<sup>88</sup> Actually these three names refer to a single species for which none of them can be used. According to the types in the South Kensington Museum, the Sydney species differs from the Philippine *D. crebriplicata* by being more delicately sculptured and more regularly fusiform. *D. lynceiformis* Kiener is a very distinct West Indian species. The spelling used by Angas showed that he took for this species the interpretation of Reeve, who figured another species under Kiener's name. *Pleurotoma fragilis* Reeve was described without locality, but Smith<sup>89</sup> has recognised it from Japan, while Bouge and Dautzenberg<sup>90</sup> had it from New Caledonia.

The representation of *P. fragilis* does not agree precisely with the Sydney shell, being a little broader and shorter, with less definite radial sculpture. We are, however, relieved of the difficulty of identifying this obscure species by the accident of a prior name. Eleven years previous to Reeve's description a fossil of the Paris Basin had received the name of *Pleurotoma fragilis* from Deshayes.<sup>91</sup> Accordingly the Sydney shell being thus left nameless, is introduced as *Daphnella botanica*, in reference to Botany Bay, i.e. New South Wales, and is defined thus:—

Shell slender-fusiform, slightly contracted at the base, spire produced. Colour:—On a buff ground the whole surface is irregularly clouded or mottled with burnt umber, the dark spaces often predominating. Whorls six, plus the protoconch, rounded, wound obliquely, excavated at the fasciole, and angled below it. Sculpture:—The protoconch of two and a half whorls is microscopically obliquely reticulated; the last whorl has about forty spiral threads, the penultimate twelve, and so on till the topmost with three is reached; between the larger threads smaller ones are intercalated, and gradually enlarge till of equal size; small sharp radials, close set at the rate of about eighty to a whorl, over-ride the spirals and produce beads at the points of intersection; these extend unbroken across the whole shell. Aperture oblique elliptical, half the length of the shell; outer lip thin and arched forward; notch deep and broad; inner lip excavating the sculpture of raised network in its path of advancement; columella with a thin callus deposit. Length 20 mm., breadth 7 mm.

<sup>88</sup> Angas—Proc. Zool. Soc., 1867, p. 203; 1880, p. 416.

<sup>89</sup> Smith—Proc. Zool. Soc., 1879, p. 198.

<sup>90</sup> Bouge and Dautzenberg—Journ. de Conch., lxi., 1914, p. 209.

<sup>91</sup> Deshayes—Descrip. Coq. Foss. Paris, ii., 1834, p. 480, pl. lxxvii., figs. 25, 26, 27.



Station:—The under surface of loose boulders at low tide level.

*Hab.* N. S. Wales:—Bottle and Glass Reef, Port Jackson (type, Brazier); Botany Heads (Hargraves). Victoria:—Western Port (Gabriel). South Australia:—St. Vincent Gulf (Verco). Western Australia (Museum Collection). Queensland:—5 to 10 fathoms, Hope Island (self).

*DAPHNELLA CESTRUM* *sp. nov.*

(Plate liii., fig. 160.)

*Clathurella debilis* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 155 (not *Clacatula debilis* Hinds, Zool. "Sulphur," i., 1844, p. 17, pl. v., fig. 16).

Shell acicular, thin, but boldly sculptured, contracted at the suture, excavate at the base; canal produced and recurved. Colour pale yellow, with two rufous brown zones, one above, the other below the periphery, both interrupted by the ribs; columella lilac; apex salmon buff. Whorls eleven, including three on the protoconch. Suture impressed, undulating. Base defined by a sharp angle which continues the horizon of the suture. Sculpture:—The fasciole area is without spirals, but is crossed by radial crescentic wrinkles; spirals may amount to twenty-seven on the last whorl, those on the periphery being alternately larger and smaller; seven of these ascend the penultimate whorl; all of these over-ride the radials; the radials are thin, high, variciform riblets, perpendicular, discontinuous, extending from below the fasciole to the angle of the base, and set at eight to a whorl. Aperture:—Outer lip simple; sinus adjacent to the suture, deeper than broad, rounded; inner lip with a thin callus; canal open, produced, and recurved. Length 10 mm., breadth 3 mm.

This shell differs from the figure of *C. debilis*, with which Brazier had identified it, by fewer bolder ribs and excavate base. In sculpture it approaches *Daphnella elegantissima* Schepman,<sup>92</sup> from which it differs by the narrower form, hollow base, and produced canal of *D. cestrum*.

*Hab.* Queensland:—20 fathoms, Darnley Island (type, Brazier); 20 fathoms, Endeavour Reef (McCulloch); 15 fathoms, Palm Islands (self).

*DAPHNELLA CHEVERTI* *sp. nov.*

(Plate liii., fig. 161.)

*Daphnella pluricarinata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159 (not *Pleurotoma pluricarinata* Reeve, Conch. Icon., i., 1845, pl. xxii., fig. 288).

Shell small, thin, narrow-fusiform, subturreted, blunt at apex, and attenuate anteriorly. Colour ochraceous-buff, gradually becoming darker towards the apex. Whorls six, of which three compose the protoconch, the last whorl rounded, the earlier ones angled at the shoulder. Sculpture delicate. The radials are close thin lamellæ which do not surmount the

<sup>92</sup> Schepman—Siboga Exped. Moll. Monogr. xlix., 1913, p. 144, pl. xxix., fig. 8.

spirals, but rise into scales along the sutures. The spirals are sharp widely-spaced threads, of which there are twenty on the body whorl, evenly distributed between the fasciole and the end of the canal; five of these ascend the penultimate. Aperture simple; lip thin; sinus wide and shallow; canal produced. Length 6.5 mm., breadth 2.6 mm.

The single specimen which Brazier identified as *D. pluricarinata* differs from authentic Philippine examples of that species by being shorter and broader, with more inflated whorls and more prominent spirals. Nearer related is *D. cymatodes* Hervier, than which *D. chercei* is smaller, more slender, and with more prominent sculpture.

*Hab.* Queensland:—30 fathoms, Darnley Island (type, Brazier).

*DAPHNELLA DILATA* Sowerby.

*Daphnella dilata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 26, pl. iii., fig. 6.

*Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 321.

*Hab.* South Australia:—St. Vincent Gulf (type); 55 fathoms, Cape Borda; 17 fathoms, Backstairs Passage (Verco).

*DAPHNELLA GRANATA* *sp. nov.*

(Plate liii., fig. 162.)

Shell rather small, solid, ovate, and sharply gradate. Colour uniform buff. Whorls seven, inclusive of the protoconch, contracted at the suture, angled at the shoulder, rounded at the periphery, and hollowed at the base. Sculpture:—Surface reticulated by elevated flat-topped spirals and radials; on the upper whorls these are of equal value, and enclose deep square meshes; the radials amount on the last whorl to twenty-five, and on the antepenultimate to about twenty; they gradually diminish in size anteriorly and vanish on the base; on the last whorl there are about seventeen spirals, not counting a few minute interstitial threads; on the penultimate there are three and on earlier whorls two spirals; the protoconch consists of two rounded whorls, superficially smooth, but on high magnification developing faint and minute oblique reticulation. Aperture imperfect in the only example seen. Length 6.5 mm., breadth 3 mm.

This species is related to *D. anticroessa* Watson, but is more solid and proportionately broader, the revolving and transverse cords few, and the reticulation coarser.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self).

*DAPHNELLA MARMORATA* Hinds.

*Daphnella marmorata* Hinds, Zool. "Sulphur," 1844, p. 25, pl. vii., fig. 19.

*Id.* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 159.

*Pleurotoma daphnelloides* Reeve, Conch. Icon., i., 1845, pl. xxiv., fig. 208.

*Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484.

*Hab.* Queensland:—30 fathoms, Darnley Island (Brazier); 8 fathoms, Weary Bay; 15 fathoms, Palm Island; 17 to 20 fathoms, Mast Head Island (self).

*DAPHNELLA ORNATA* Hinds.

*Daphnella ornata* Hinds, Zool. "Sulphur," 1844, p. 25, pl. vii., fig. 21.  
*Id.* Schmeltz, Mus. Godeffroy Cat., iv., 1869, p. 90. *Id.* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 158. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 210.

*Daphnella tessellata* Garrett, Proc. Acad. Nat. Sci. Philad., 1873, p. 230, pl. iii., fig. 61.

*Hab.* Queensland:—20 fathoms, Darnley Island (Brazier); Lizard Island (self).

*DAPHNELLA SIGMASTOMA* *sp. nov.*

(Plate liv., figs. 163, 164.)

*Clathurella arcata* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 294 (not *Pleurotoma arcata* Reeve, Conch. Icon., i., 1845, pl. xxxii., fig. 294).

Shell small, elongate-fusiform. Colour uniform pale yellow, except the apex, which is buff. Whorls rounded, ten, including those of the elevated protoconch. Sculpture:—The fasciole is narrow, excavate, and crossed by close-set scales; the radials are arcuate round-backed riblets, parted by interstices of equal breadth, fading out on the base, absent behind the varix, amounting to thirteen on the antepenultimate; the spirals are close narrow threads, alternating in size on the peripheral area, and over-riding the riblets; on the last whorl there are twenty-five, of which ten ascend the penultimate. Aperture fortified by a broad and high varix, from which a free limb reaches across the mouth, reducing the width of the aperture. The sinus is a long and narrow fold. Within the lip and beneath the sinus are two small denticles. Columella perpendicular; canal short and wide. Length 8.5 mm., breadth 3 mm.

*Hab.* Queensland:—15 fathoms, Palm Island (type); 5 to 10 fathoms, Hope Island (self); 4 to 14 fathoms, Albany Passage (self); 20 fathoms, Endeavour Reef (McCulloch); 20 fathoms, Darnley Island (Brazier).

The group to which this and *D. cestrum* belong are separated from typical *Daphnella* by slender form, prominent ribs and varix. *Clathurella papuensis* Tapparone Canefri,<sup>35</sup> which I only know from the figure, is perhaps related.

*DAPHNELLA STIPHRA* Verco.

*Daphnella stiphra* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 322, pl. xxv., figs. 5, 6.

*Hab.* South Australia:—300 fathoms, Cape Jaffa (type); 15 fathoms, Wallaroo (Verco); 365 fathoms, Cape Martin (self).

<sup>35</sup> Tapparone Canefri—Bull. Soc. Zool. France, iii., 1878, p. 247, pl. vi., figs. 5, 6.

DAPHNELLA TERINA *Melvill and Standen.*

*Daphnella terina* Melvill and Standen, Journ. of Conch., viii., 1896, p. 296, pl. x., fig. 43. *Id.* Bonge and Dantzenberg, Journ. de Conch., lxi., 1914, p. 212.

Specimens of this species from Funafuti were erroneously recorded by myself as *Daphnella lymneiformis* Kiener.<sup>94</sup>

*Hab.* Queensland:—30 fathoms, Darnley Island (Brazier); 5 to 8 fathoms, Murray Island (self).

VEPRECTULA *Melvill.*

*Vepracula* Melvill, Proc. Malac. Soc., xii., 1917, p. 188.

This genus is distinguished by a slender fusiform shell, which is reticulated by radial and spiral cords, producing a sharp point at each intersection. The protoconch is tall and elaborately frilled, and the sutural sinus is deep and narrow. Type *Clathurella sykesii* Melvill and Standen, 1903.

Besides the following Australian species and the type two Indian species are included—*Pleurotoma asperulata* Smith, 1882, and *P. reticulosa* Smith, 1882, as well as *V. cooperi* Mestayer, 1919, from New Zealand.

VEPRECTULA SCALA *sp. nov.*

(Plate liv., fig. 165.)

Shell slender, fusiform, excavate at the base and below the suture. Colour burnt sienna, with a cream zone on the shoulder of the last whorl. A tall and narrow protoconch of four whorls, delicately radially ribbed, is followed by five adult whorls. Sculpture:—Spaced spiral cords over-run the ribs and form small scales on their summits, four on the penultimate, then three and two on earlier whorls; on the final whorl they extend to the tip of the snout, and number about sixteen; the radial ribs are closely packed above, and are more spaced as they descend; on the last whorl they decrease to six in number, and are narrow, erect, and oblique; they vanish on the base. Aperture:—Canal produced, and a little twisted; notch sutural, rather deep and narrow. Length 5.5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self); 10 fathoms, York Island (Brazier).

VEPRECTULA VACILLATA *sp. nov.*

(Plate liv., fig. 166.)

Shell small, acuminate, excavate at the base and below the suture. Colour buff, sometimes suffused with chocolate. An acicular protoconch of three whorls is followed by five adult whorls. Sculpture:—Deep square

<sup>94</sup> Hedley—Mem. Austr. Mus., iii., 1899, p. 476.

meshes are enclosed by radial and spiral cords, with small prickles at the point of intersection; both radials and spirals vary in their development; on the last whorl there may be from nine to twelve radials, and from fifteen to eighteen spirals; on the upper whorl there are from three to five spirals, the peripheral one dominating. Aperture:—The notch is sutural and rather deep; the outer lip is dentate by the projection of the spirals; the canal is rather long and straight. Length 5.5 mm., breadth 2 mm.

This species approaches the Indian *V. asperulata*, in which the sculpture is much finer.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 5 to 8 fathoms, Palm Island; 17 to 20 fathoms, Mast Head Island (self).

Var. *PAUCICOSTATA* var. nov.

(Plate liv., fig. 167.)

With fewer spiral cords than in the typical form, the specimen here figured has six radials.

*Hab.* Queensland:—Murray Island and Hope Island (self).

*VEPRESCULA VEPRATICA* Hedley.

(Figure 9.)

*Pleurotoma vepatica* Hedley, Mem. Austr. Mus., iv., 1903, p. 384, fig. 97.

*Clathurina (Veprescula) vepatica* Melvill, Proc. Malac. Soc., xii., 1917, p. 140, pl. x., fig. 14.

This is larger than the other Australian species. Dr. J. C. Melvill has lately extended the range of it to Japan and the Persian Gulf. The citation in the original account of this species from Torres Straits refers to a specimen of *V. vacillata*.

*Hab.* N. S. Wales:—24 to 100 fathoms, Wollongong to Port Stephens ("Thetis").

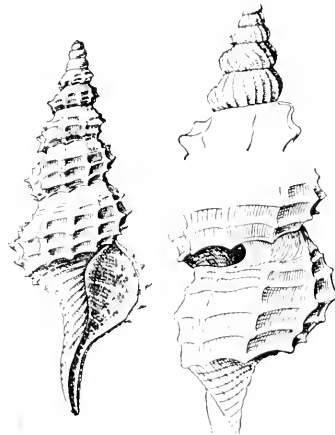


Fig. 9.

*HEMIDAPHNE* Hedley.

*Hemidaphne* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M 83. Type *Pleurotoma souverbiei* Smith, 1882.

A genus of the *Daphnellinae*, distinguished from *Daphnella* by more cylindrical form, more solid shell; usually carrying widely-spaced strong radiating ribs on the upper whorls, while the lower are comparatively smooth.

This group was early segregated, though not named, by G. and H. Nevill<sup>95</sup> as for a section of *Clathurella*. By Boettger<sup>96</sup> it was confused with *Paracathurella*, but Smith, who better appreciated the real relationship of *Hemidaphne*, remarked<sup>97</sup> on the difference of the apex.

Besides the Australian species here discussed, the following extralimital species may be included in this genus:—*Pleurotoma lirata* Reeve, 1845; *Pleurotoma cereana* Deshayes, 1863 = *Pleurotoma concinna* Dunker, 1856 (not Scacchi, 1836) = *Clathurella tumida* Pease, 1867; *Pleurotoma subula* Reeve, 1845; and *Daphnella supracancellata* Schepmann, 1913.

#### HEMIDAPHNE AXIS *Reeve*.

*Pleurotoma axis* Reeve, Conch. Icon., i., Jan. 1846, pl. xxxiv., fig. 311, and Proc. Zool. Soc., May 1846, p. 3. *Id.* Smith, Zool. "Alert," 1884, p. 40.

*Clathurella axis* Boettger, Nach. Malak. Gesell., xxvii., 1895, p. 57. *Id.* Hidalgo, Revist. Acad. Cienc. Madrid, i., 1904, p. 340.

*Daphnella axis* Melvill and Standen, Proc. Zool. Soc., 1901, p. 447. *Id.* Melvill, Proc. Malac. Soc., xii., 1917, p. 191.

*Daphnella subula* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 158 (not *Pleurotoma subula* Reeve).

*Hab.* Queensland:—14 fathoms, Port Mollie (Coppinger); 8 to 30 fathoms, Darnley Island (Brazier).

#### HEMIDAPHNE CYCLOPHORA *Deshayes*.

(Plate liv., fig. 168.)

*Pleurotoma cyclophora* Deshayes, Moll. de Renneion, 1863, p. 111, plate xii., figs. 19-21.

*Clathurella cyclophora* G. and H. Nevill, Journ. Asiat. Soc. Bengal, xliv., 1875, p. 88.

*Mangelia cyclophora* von Martens, in Mobius Meeresfauna Mauritius, 1880, p. 228.

The Australian shell is 10 mm. long, and therefore considerably larger than the type, which is only 7 mm. long; but judging from literature, this form may be counted as a variety of the species of Deshayes. To facilitate recognition it is here figured.

*Hab.* Queensland:—Murray Island and Mast Head Island (self).

<sup>95</sup> G. and H. Nevill—Journ. Asiat. Soc. Bengal, xliv., 1875, p. 88.

<sup>96</sup> Boettger—Nachr. Malak. Gesell., xxvii., p. 57.

<sup>97</sup> Smith—Zool. Coll. "Alert," p. 39.

HEMIDAPHNE RISSOIDES *Reeve*.

*Pleurotoma rissoides* Reeve, Conch. Icon., i., 1843, pl. xiii., fig. 111, and Proc. Zool. Soc., 1843 (1844), p. 184.

*Clathurella rissoides* Tryon, Man. Conch., vi., 1884, p. 281, pl. xxvii., figs. 8, 9. *Id.* Boettger, Nachr. Malak. Gesell., 1895, p. 57. *Id.* Melvill and Standen, Journ. of Conch., viii., 1897, p. 403. *Id.* Hidalgo, Revist. Acad. Cienc. Madrid, i., 1904, p. 342.

*Daphnella rissoides* M'Andrew, Ann. Mag. Nat. Hist. (4), vi., 1870, p. 438. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 211.

*Pleurotoma dentatum* Souverbie, Journ. de Conch., xvii., 1869, p. 418, and xviii., 1870, p. 431, pl. xiv., fig. 5.

*Daphnella dentata* Hervier, Journ. de Conch., xlv., 1869, p. 149.

*Pusioneella testabilis* Jousseaume, Le Naturaliste, x., 1896, p. 43, *vide* E. A. Smith in Fulton, Proc. Malac. Soc., xv., 1922, p. 27.

\* *Hab.* Queensland:—Murray and Palm Islands (self).

HEMIDAPHNE SOUVERBIEI *Smith*.

*Pleurotoma (Daphnella) souverbiei* Smith, Ann. Mag. Nat. Hist. (5), x., 1882, p. 300. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1908, p. 488, pl. viii., fig. 9.

*Daphnella souverbiei* Hedley, Journ. Roy. Soc. W.A., i., 1916, p. 206.

This species is related to *H. rissoides*, but is larger and lacks the coloured apex of that shell.

*Hab.* Western Australia:—Swan River (type, British Museum). Queensland:—Burleigh Heads (G. Gross).

EXOMILUS *Hedley*.

*Exomilus* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M 81. Type *Mangilia latraria* Hedley.

Shell small, subcylindrical. Whorls few. Base concave. Sculpture:—Radial ribs latticed by spiral cords. Outer lip slightly thickened, denticulate within. Sinus shallow, subsutural.

This group has some resemblance to *Pseudodaphnella*, and may be an offshoot from that genus which has assumed a narrower contour and migrated to cooler and deeper water.

EXOMILUS ANXIUS *Hedley*.

*Mangilia anxia* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 455, pl. xliii., fig. 89.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type); 5 to 8 fathoms, Murray Island; 17 to 20 fathoms, Mast Head Island (self); off Cairns Reef (McCulloch).

EXOMILUS CANCELLATUS *Beddome*.

*Mangilia cancellata* Beddome, Proc. Roy. Soc. Tasm., 1882, p. 167.

*Drillia cancellata* Tate and May (not of Carpenter, 1865), Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 368, pl. xxiv., fig. 27. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 306.

*Hab.* Tasmania:—Tamar River (type); Circular Head (Petterd); Frederick Henry Bay (May).

EXOMILUS DYSCRITOS *Verco*.

*Terebra dyscritos* Verco, Trans. Roy. Soc., S.A., xxx., 1906, p. 149, pl. iv., figs. 3, 4, 5.

*Mangilia dyscritos* Hedley and May, Rec. Austr. Mus., vii., 1908, p. 112. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 315.

*Hab.* South Australia:—22 fathoms, St. Vincent Gulf (type); 100 fathoms, Beachport; 130 fathoms, Cape Jaffa; 55 fathoms, Cape Borda (Verco). Tasmania:—100 fathoms, Cape Pillar (Hedley and May).

EXOMILUS FENESTRATUS *Tate and May*.

*Donovania fenestrata* Tate and May, Trans. Roy. Soc., S.A., xxiv., 1900, p. 94, and Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 372, pl. xxiv., fig. 36. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 52. *Id.* Hedley and May, Rec. Austr. Mus., vii., 1908, p. 112. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 271, pl. xxi., figs. 8, 9.

*Trophon fenestratus* May, Check List Mollusca, Tasmania, 1921, p. 85.

*Hab.* Tasmania:—East Coast (type); 100 fathoms, Cape Pillar (May). South Australia:—McDonnell Bay (Torr); 110 fathoms, Beachport; 130 fathoms, Cape Jaffa (Verco). Victoria:—Flinders (Gatliff).

EXOMILUS LUTRARIUS *Hedley*.

*Mangelia lutraria* Hedley, Rec. Austr. Mus., vi., 1907, p. 296, pl. liv., figs. 11, 12.

*Hab.* N. S. Wales:—80 fathoms, 22 miles east of Narrabeen (type, self).

EXOMILUS PENTAGONALIS *Verco*.

*Drillia pentagonalis* Verco, Trans. Roy. Soc. S.A., xx., 1896, p. 222, pl. vii., fig. 6. *Id.* Hedley, Rec. Austr. Mus., vi., 1907, p. 298. *Id.* May, Proc. Roy. Soc. Tasm., 1915, p. 76.

*Hab.* South Australia:—Backstairs Passage (type, Verco). Tasmania:—40 fathoms, Schouten Island; 50 to 70 fathoms, Port Arthur (May). N.S.Wales:—80 fathoms, Narrabeen (self).



## EXOMILUS SPICA Hedley.

*Mangilia spica* Hedley, Rec. Austr. Mus., vi., 1907, p. 297, pl. lv., fig. 20, and vii., 1908, p. 112. *Id.* Verco, Trans. Roy. Soc. S.A., xxxi., 1907, p. 215, and xxxiii., 1909, p. 314.

*Hab.* N. S. Wales:—80 fathoms, Narrabeen (type); 100 fathoms, Wollongong (self). Tasmania:—100 fathoms, Cape Pillar (Hedley and May). South Australia:—110 fathoms, Beachport; 130 fathoms, Cape Jaffa (Verco).

## EXOMILUS TELESCOPICALIS Verco.

*Drillia telescopialis* Verco, Trans. Roy. Soc. S.A., xx., 1896, p. 222, pl. vii., fig. 1. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 172.

*Hab.* South Australia.—Backstairs Passage (type, Verco). Victoria:—Portsea (Hall).

## NEPOTILLA Hedley.

*Nepotilla* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M 83, Type *Daphnella bathytoma* Verco.

This genus of the *Daphnellinae* is allied to *Eucyclotoma* by its spirally grooved protoconch, but distinguished therefrom by minute size, turreted spire, and few whorls.

This group is mainly southern, and from deep water. In south New Zealand it is represented by *Daphnella totolirata* Suter, and *Mangilia flexicostata* Suter. Apart from its different protoconch, *Pleurotoma hirsutum* de Folin has a general resemblance in size, shape, and sculpture to *Nepotilla*.

## NEPOTILLA ACULEATA May.

*Taranis aculeata* May, Proc. Roy. Soc. Tasm., 1915, p. 83, pl. i., fig. 1.

*Hab.* Tasmania:—50 fathoms, Thonin Bay (type, May).

## NEPOTILLA BATHENTOMA Verco.

*Daphnella bathentoma* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 326, pl. xxviii., fig. 3. *Id.* May, Proc. Roy. Soc. Tasm., 1910, p. 308.

*Hab.* South Australia:—104 fathoms, Neptune Island (type, Verco). Tasmania:—100 fathoms, Cape Pillar (May). N.S.Wales:—80 fathoms, Narrabeen; and 100 fathoms, Wollongong (self).

## NEPOTILLA DIAPHANA May.

*Nepotilla diaphana* May, Proc. Roy. Soc. Tasm., 1919, p. 56, pl. xiv., fig. 3.

*Hab.* Tasmania:—Frederick Henry Bay (type); Thonin Bay (May).

NEPOTILLA EDWINI *Brazier*.

*Pleurotoma (Clathurella) edwini* Brazier, Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 168, pl. xiv., fig. 3.

*Taranis edwini* May, Proc. Roy. Soc. Tasm., 1908, p. 53.

*Hab.* N. S. Wales:—Port Jackson (type, Henn). Tasmania:—100 fathoms, Cape Pillar (May).

NEPOTILLA EXCAVATA *Gatliff*.

*Daphnella excavata* Gatliff, Proc. Roy. Soc. Vict., xix., 1906, p. 1, pl. i., figs. 1, 2. *Id.* Hedley and May, Rec. Austr. Mus., vii., 1908, p. 112. *Id.* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 327.

*Hab.* Victoria:—Point Nepean (type, Gatliff). Tasmania:—100 fathoms, Cape Pillar (Hedley and May). South Australia:—11 fathoms, Backstairs Passage (Vervo). N.S. Wales:—Coogee (Brazier).

NEPOTILLA FENESTRATA *Vervo*.

*Daphnella fenestrata* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 321, pl. xxviii., figs. 6, 7. *Id.* May, Proc. Roy. Soc. Tasm., 1915, p. 75.

*Hab.* South Australia:—104 fathoms, Neptune Island (type, Vervo). Tasmania:—50 fathoms, Port Arthur (May).

NEPOTILLA LAMELLOSA *Sowerby*.

*Clathurella lamellosa* Sowerby, Proc. Malac. Soc., ii., 1896, p. 28, pl. iii., fig. 11.

*Daphnella lamellosa* Vervo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 325. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxii., 1910, p. 90. *Id.* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 308.

*Hab.* South Australia:—St. Vincent Gulf (type); 90 fathoms, Cape Jaffa; 110 fathoms, Beachport; 20 fathoms, St. Francis Island (Vervo). Victoria:—Wilson's Promontory ("Endeavour"). Tasmania:—40 fathoms, Schouten Island; 100 fathoms, Cape Pillar (May).

NEPOTILLA MICROSCOPICA *May*.

*Taranis microscopica* May, Proc. Roy. Soc. Tasm., 1915, p. 84, pl. i., fig. 2.

*Daphnella microscopica* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxix., 1916, p. 108.

*Hab.* Tasmania:—40 fathoms, Thoun Bay (type, May); Bass Straits (Gatliff and Gabriel).

NEPOTILLA MINUTA *Tenison-Woods*.

*Drillia minuta* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 136.  
*Id.* May, Proc. Roy. Soc. Tasm., 1902, p. 110. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 68. *Id.* Tryon, Man. Conch., vi., 1884, p. 210, pl. xxxiv., fig. 93. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 172.

*Daphnella minuta* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., p. 372, pl. xxvi., fig. 28.

*Daphnella mimica* var. *fusca* Sowerby, Proc. Malac. Soc., ii., 1896, p. 27.

*Hab.* Tasmania:—Bruni Island (type); Frederick Henry Bay (May).  
 Victoria:—Western Port (Pritchard). South Australia:—St. Vincent Gulf (Adcock).

NEPOTILLA MINICA *Sowerby*.

*Daphnella minica* Sowerby, Proc. Malac. Soc., ii., 1896, p. 27, pl. iii., fig. 10. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 52.

*Daphnella minuta* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 326.

*Hab.* South Australia:—St. Vincent Gulf (type); 90 fathoms, Cape Jaffa; 20 fathoms, St. Francis Island (Verco). Victoria:—Western Port (Pritchard). Tasmania:—40 to 50 fathoms, Schouten Island (May).

Var. MARMORATA *Verco*.

Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 327.

NEPOTILLA TRISERIATA *Verco*.

*Daphnella triseriata* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 325, pl. xxviii., fig. 8. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxvi., 1913, p. 74. *Id.* May, Proc. Roy. Soc. Tasm., 1910, p. 308.

*Hab.* South Australia:—100 fathoms, Beachport (type); 90 to 130 fathoms, Cape Jaffa (Verco). Victoria:—40 fathoms, Ninety-Mile Beach (Gatliff and Gabriel). Tasmania:—40 fathoms, Schouten Island (May).

NEPOTILLA TROPICALIS *sp. nov.*

(Plate liv., fig. 169.)

*Daphnella excavata* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1907, p. 507 (not *D. excavata* Gatliff).

Shell small, subsellar. Colour dull white. Whorls four, of which one and a half form the protoconch. Each whorl spreads in a broad shelf above, and thence narrows anteriorly. Sculpture:—On the last whorl there are four, and on the earlier two, spiral cords, the topmost running along the angle of the shell; the radials which over-ride these are thin

elevated lamellæ, commencing at the suture and ending as imbricating scales on the snout; there are sixteen on the last whorl. Aperture:—Lip simple, sinus short and subsutural; canal short. Length 1.55 mm., breadth 0.85 mm.

Allied to *N. eecarata*, to which at first I had referred it. On reconsideration I think it separable by shorter, broader form, and by more numerous radials, which do not project at the shoulder as in *eecarata*.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island (type, self).

ASPERDAPHNE *nom. nov.*

*Asperdaphne nom. nov.* for *Scabrella* Hedley, Journ. Roy. Soc. N.S.W., li., 1918, suppl. p. M. 83 (not *Scabrella* Sacco, Moll. Piemonte Liguria, pt. vi., 1890, p. 54, type *Columbella scabra* Bellardi). Type *Daphnella versirestita* Hedley.

This genus resembles *Daphnella* in form and general appearance, but differs in having the nucleus spirally grooved instead of being obliquely reticulated. The contour is lanceolate rather than oval; the shell has usually more whorls, increasing less rapidly, with a longer and more turreted spire; and the anal fasciole is usually more marked than in *Daphnella*, being more excavate, and crossed by sharp crescentic riblets. Some members of this genus have a superficial resemblance to *Defrancia*, under which genus they have been arranged.

*Clathurella dictygota* Hutton, and *Daphnella aculeata* Webster, from New Zealand, may be included here.

The citation by Schmeltz<sup>98</sup> of *Defrancia pumila* Mighels from Bass Straits is an obvious error. *Clathurella reticosta* Adams and Angas<sup>99</sup> 100 is a synonym of the British *Mangilia purpurea* Montagu.

ASPERDAPHNE *ALBOCINCTA* Angas.

(Plate liv., fig. 170.)

*Clathurella albocincta* Angas, Proc. Zool. Soc., 1871, p. 18, pl. i., fig. 22.

*Id.* Gatliff and Gabriel, Proc. Roy. Soc. Viet., xxi., 1908, p. 376.

*Hab.* N.S.Wales:—Sow and Pigs Reef, Port Jackson (type, Brazier); Dndley: Twofold Bay (self). Victoria:—Port Albert (Gatliff and Gabriel).

ASPERDAPHNE *AMPECTA* *sp. nov.*

(Plate liv., figs. 171, 172.)

*Clathurella amabilis* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 154 (not

*Clacatula amabilis* Hinds, Zool. "Sulphur," 1844, p. 21, pl. vii., fig. 3).

<sup>98</sup> Schmeltz—Cat. Mus. Godeffroy, v., 1874, p. 132.

<sup>99</sup> Adams and Angas—Proc. Zool. Soc., 1863, p. 42.

<sup>100</sup> Hedley—Mem. Austr. Mus., iv., 1903, p. 390.

Shell fusiform. Whorls nine, including the protoconch. Colour dull white. Protoconch of two rounded microscopically spirally grooved whorls. Sculpture:—On the first adult whorl there are nine or ten radials, which decrease to six on the lower whorls; these are discontinuous, prominent, vertical, ceasing at the fasciole and on the base; the spirals are evenly spaced, sharp, elevated, over-riding and denticulating the ribs, increasing by intercalation from two above to about eighteen below; these are again traversed by a secondary sculpture of fine radiating threads; fasciole broad, excavate, crossed by close, sharp, and crescentic lamellæ. Aperture imperfect in my example; canal slightly twisted. Length 12 mm., breadth 5 mm.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type); 5 to 8 fathoms, Murray Island (self); 20 fathoms, Darnley Island (Brazier).

ASPERDAPHNE BASTOWI *Gatliff* and *Gabriel*.

*Daphnella bastowi* Gatliff and Gabriel, Proc. Roy. Soc. Viet., xi., 1908, p. 365, pl. xxi., figs. 1-4. *Id.* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 324.

*Hab.* Victoria:—Western Port (type, Gabriel). South Australia:—St. Vincent Gulf (Vereo).

ASPERDAPHNE BELA *nom. nov.*

*Bela tasmanica* May, Proc. Roy. Soc. Tasm., 1915, p. 84, pl. i., fig. 3 (not *Daphnella tasmanica* Tenison-Woods, 1877, now transferred to *Asperdaphne*).

*Hab.* Tasmania:—D'Entrecasteaux Channel; 10 fathoms, (type, May).

ASPERDAPHNE BRENCHLEYI *Angas*.

(Figure 10.)

*Clathrella brechleyi* Angas, Proc. Zool. Soc., 1877, p. 37, pl. v., fig. 12.

*Daphnella brechleyi* Hedley, Mem. Austr. Mus., iv., 1903, p. 391, fig. 106.

*Hab.* N.S. Wales:—Port Stephens (type, Angas); 50 fathoms, Cape Three Points ("Thetis").

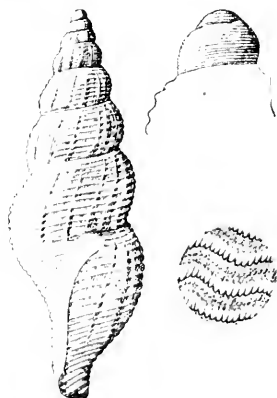


FIG. 10.

*ASPERDAPHNE CAPRICORNEA* *sp. nov.*

(Plate liv., fig. 173.)

Shell small, lanceolate, contracted at the sutures; substance rather thin and translucent. Colour either white, buff, or pale pink above, afterwards turning to buff or white; three apical whorls always darker, usually brown buff. Whorls seven and a half, including a protoconch of two whorls. Sculpture:—Fine spiral grooves, crossed by still finer radials, ornament the protoconch; the third whorl has a prominent keel on the shoulder, beneath which is a fainter spiral; on the fourth whorl the radials first appear as eight prominent round-backed ribs, crossed by two, afterwards three, spiral cords, forming deep meshes by their intersection; the ribs descend continuously and obliquely from whorl to whorl, but decrease in relative importance; the spirals multiply by intercalation till on the last whorl they amount to twenty-five, but there also they are insignificant compared to their initial stage; two or three of the peripheral spirals project beyond the succeeding fasciole; fasciole distinct, crossed by sharp thread-like radials. Aperture:—Sinus simple, rather shallow; inner lip with a slight callus; canal short and recurved. Length 4.5 mm., breadth 2 mm.

*Hab.* Queensland:—17 to 20 fathoms, Mast Head Island (type); 5 to 8 fathoms, Murray Island (self).

*ASPERDAPHNE COMPACTA* *sp. nov.*

(Plate lv., fig. 174.)

Shell small, rather solid, ovate-conic. Colour uniform buff. Whorls six, of which two compose the protoconch. Sculpture:—Protoconch is gradate, and coarsely, spirally, engraved; the subsequent whorls are rounded and excavate at the fasciole; radial ribs prominent, rounded, extending from the fasciole to the base, set their own breadth apart, about twelve to a whorl; the spirals are delicate threads over-riding the radials; on the last whorl they amount to twenty-four, of which three or four on the periphery are larger than the rest; fasciole sharply sculptured by crescentic lamellæ. Aperture imperfect in my material; sinus sutural, and of moderate depth. Length 6.5 mm., breadth 3 mm.

This species is broader and more harshly sculptured than *A. desalesii*. It is nearer to *A. legrandi*, but the apex is not so sharp, and the radial ribs of the last whorl are less prominent and more numerous. In error I have recorded<sup>101</sup> this as *Daphnella sculptior*.

*Hab.* N.S. Wales:—80 fathoms, off Narrabeen (type, self).

<sup>101</sup> Hedley Rec. Austr. Mus., vi., 1907, p. 298.

ASPERDAPHNE DESALESII *Tenison-Woods*.

(Figure 11.)

*Mangelia desalesii* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 138. *Id.* Hedley, Rec. Austr. Mus., iv., 1901, p. 23, fig. 4.

*Clathurella desalesii* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 371, pl. xxiv., fig. 32. *Id.* Vereo, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 310.

*Scabrella desalesii* May, Check-list Mollusca Tasmania, 1921, p. 78.

*Clathurella sculptor* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 38. *Id.* Tryon, Man. Conch., vi., 1884, p. 282, pl. xxxii., fig. 27. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 65.

*Clathurella scindentata* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 104, pl. viii., fig. 7.

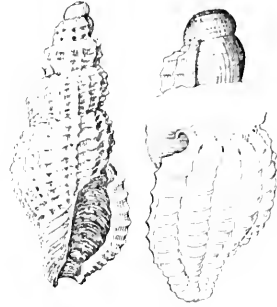


Fig. 11.

Mr. W. L. May, who enjoyed special opportunities for investigation, has kindly advised me on the above synonymy.

*Hab.* Tasmania:—4 fathoms, Long Bay (types of both *desalesii* and *sculptor*, Petterd); Frederick Henry Bay (May). Victoria:—Sorrento Beach, (type of *scindentata*, Gatliff). South Australia:—40 fathoms, Beachport; 130 fathoms, Cape Jaffa; St. Vincent Gulf (Vereo).

ASPERDAPHNE ESPERANZA *May*.

*Hemipleurotoma esperanza* May, Proc. Roy. Soc. Tasm., 1910 (1911), p. 390, pl. xiii., fig. 15.

*Bathytoma gratiosa* Suter, from South New Zealand, is nearly related to this species.

*Hab.* Tasmania:—24 fathoms, Port Esperance (type); 40 fathoms, 3 miles east of Schouten Island (May).

ASPERDAPHNE HAYESIANA *Angas*.

*Clathurella hayesiana* Angas, Proc. Zool. Soc., 1871, p. 17, pl. i., fig. 17.

*Hab.* N.S.Wales:—Lane Cove (type, Brazier).

ASPERDAPHNE LEGRANDI *Beddome*.

*Drillia legrandi* Beddome, Proc. Roy. Soc. Tasm., 1882 (1883), p. 167.

*Clathurella legrandi* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xii., 1900, p. 178. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxv., p. 509, pl. xxv., figs. 1, 2, 3.

*Daphnella legrandi* Gatliff and Gabriel, Proc. Roy. Soc., xxi., 1908, p. 375.  
*Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 323.

*Hab.* Tasmania:—D'Entrecasteaux Channel (type, Beddome). Victoria:—Portland (Maplestone); San Remo (Gatliff). South Australia:—20 fathoms, St. Vincent Gulf; 110 fathoms, Beachport; 15 to 35 fathoms, St. Francis Island (Verco).

ASPERDAPHNE MAYI Verco.

*Hemipleurotoma mayi* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 295, pl. xxv., fig. 2.

*Daphnella mayi* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxv., 1912, p. 170.

*Hab.* South Australia:—104 fathoms, Neptune Island (type, Verco); 300 fathoms, Cape Nelson; 365 fathoms, Cape Martin (self).

ASPERDAPHNE MORETONICA Smith.

*Pleurotoma (Defrancia) moretonica* Smith, Ann. Mag. Nat. Hist. (5), x., Oct. 1882, p. 299.

*Clathurella moretonica* Tryon, Man. Conch., vi., 1884, p. 299. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxiii., 1908, p. 489, pl. viii., fig. 14.

*Hab.* Queensland:—Moreton Bay (type, Strange).

ASPERDAPHNE PERISSA Hedley.

*Mangilia perissa* Hedley, Proc. Linn. Soc. N.S.W., xxxiv., 1909, p. 459, pl. xlv., figs. 96, 97.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island (type, self).

ASPERDAPHNE PERPLEXA Verco.

*Daphnella perplexa* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 323, pl. xxviii., figs. 1, 2.

*Hab.* South Australia:—12 fathoms, Backstairs Passage (type); St. Vincent Gulf (Verco).

ASPERDAPHNE SCULPTILIS Angus.

*Clathurella sculptilis* Angus, Proc. Zool. Soc., 1871, p. 17, pl. i., fig. 1. *Id.* Tenison-Woods, Proc. Roy. Soc. Tasm., 1878 (1879), p. 38. *Id.* Tate and May, Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 37.

*Daphnella sculptilis* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxi., 1908, p. 375 (not *Daphnella sculptilis* Harris, Brit. Mus. Cat. Tert. Moll. Austr., 1897, p. 61).

*Daphnella angasi* Hedley, Mem. Austr. Mus., iv., 1903, p. 391.



*Hab.* N.S.Wales:—Sow and Pigs Reef, Port Jackson (type, Brazier); 41 to 50 fathoms, Cape Three Points ("Thetis"); 25 to 30 fathoms, Norah Head (McNeill and Livingstone). Tasmania:—Long Bay (Tenison-Woods). Victoria:—Western Port (Gatliff).

*ASPERDAPHNE TASMANICA* Tenison-Woods.

(Figure 12.)

*Daphnella tasmanica* Tenison-Woods, Proc. Roy. Soc. Tasm., 1876 (1877), p. 138. *Id.* Hardy, Proc. Roy. Soc. Tasm., 1915, p. 70. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxv., 1901, p. 725, text fig. 21. *Id.* May, Proc. Roy. Soc. Tasm., 1902, p. 110. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Vict., xviii., 1906, p. 52.

*Hab.* Tasmania:—D'Entrecasteaux Channel (type, Petterd). Victoria:—17 fathoms, Western Port (Gatliff). South Australia:—23 fathoms, St. Vincent Gulf; 35 fathoms, St. Francis Island (Verco).

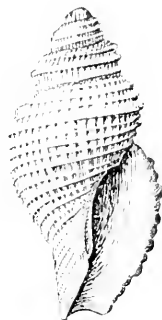


Fig. 12.

Var. *BITORQUATA* Sowerby.

*Daphnella bitorquata* Sowerby, Proc. Malac. Soc., ii., 1896, p. 27, pl. iii., fig. 10. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 324. *Id.* Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxiii., 1910, p. 90.

*Hab.* South Australia:—Spencer and St. Vincent Gulfs (type, Adcock). Victoria:—San Remo (Gatliff).

*ASPERDAPHNE VERCOI* Sowerby.

(Plate lv., figs. 175, 176.)

*Clathurella breuchleyi* Tate, Trans. Roy. Soc. S.A., xvii., 1893, p. 199.

*Daphnella vercoi* Sowerby, Trans. Malac. Soc., ii., 1896, p. 27, pl. iii., fig. 8. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 320.

Dr. Verco thought that this should be reduced to a variety of *A. breuchleyi*. To me it seems that the geographic separation is sufficiently supported by the stronger and fewer radials and stouter form of *S. vercoi* to maintain it as a distinct species. Probably the South Australian shells identified by Professor Tate as *C. breuchleyi* were really a slender form of *A. vercoi*.

*Hab.* South Australia:—6 to 20 fathoms, Backstairs Passage (type); Investigator Strait; St. Vincent Gulf and Spencer Gulf (Verco).

*ASPERDAPHNE VERSIVESTITA* Hedley.

*Daphnella versivestita* Hedley, Rec. Austr. Mus., viii., 1912, p. 148, pl. xliii., fig. 33.

*Hab.* N.S.Wales:—Botany Heads (type); Woolgoolga to Gerringong.

## ASPERDAPHNE VESTALIS Hedley.

(Figure 13.)

*Daphnella vestalis* Hedley. Mem. Austr. Mus., iv., 1903, p. 390, fig. 105.

*Hemipleurotoma vestalis* Verco. Trans. Roy. Soc. S.A., xxxiii., 1909, p. 295.

*Hab.* N. S. Wales:—41 to 50 fathoms, Cape Three Points (type); 24 fathoms, Port Stephens; 50 to 52 fathoms, Botany Heads ("Thetis"). South Australia:—104 fathoms, Neptune Island (Verco).



Fig. 13.

## ASPERDAPHNE WALCOTE Sowerby.

*Drillia walcote* Sowerby, Proc. Zool. Soc., 1893, p. 487, pl. xxxviii., figs. 7, 8. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 24.

*Clathurella walcote* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 307.

*Hab.* South Australia:—Spencers Gulf (type); MacDonnell Bay (Adcock); 20 fathoms, Backstairs Passage; 40 fathoms, Beachport; beach, St. Francis Island (Verco).

## PSEUDODAPHNELLA Boettger.

*Pseudodaphnella* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 58. Type *Pleurotoma philippiensis* Reeve, 1843.

*Kernia* Oliver, Trans. N.Z. Inst., xlvii., 1914 (1915), p. 539. Type *Kernia beuchami* Oliver, 1915.

*Clathurina* Melvill, Proc. Malac. Soc., xii., 1917, p. 185. Type *Pleurotoma foraminata* Reeve, 1845.

Though introduced more than twenty years ago, this generic name, *Pseudodaphnella*, has been refused recognition by most modern writers, who have distributed its constituents among *Mangilia*, *Clathurella*, or *Daphnella*.

The size is rather large. The colour may be various shades of brown or yellow, disposed often in dots on a white, sometimes opaque, ground. There is a small brown mucronate apex of two or three whorls, the first spirally engraved, the next with oblique lattice lines. The adult shell is netted over by elevate spirals and radials enclosing deep oblong meshes; at the points of intersection are small sharp cusps. The aperture is wide and free from tubercles or plications on the columella side, and generally without a varix. Sinus subsutural, broad, and shallow. There is no fasciole band distinguishable.

The genus is associated with reef corals, and has a habit of sheltering under loose stones between tide marks.

*PSEUDODAPHNELLA ATTENUATA* *sp. nov.*

(Plate Iv., fig. 177.)

Shell rather solid and tall, lanceolate. Colour uniform yellow. Whorls seven remaining. Sculpture:—Large deep meshes are formed on the body of the shell by the intersection of the main sculpture; the ribs are nine on the penultimate and eleven on the last whorl, elevated, perpendicular, alternating from whorl to whorl, twice their breadth apart, vanishing on the base and below the suture; spirals sharp, elevated cords, thirteen on the body whorl, three on the penultimate, over-riding the ribs; on the snout the ribs only survive as nodules; along the fasciole area the spirals are entirely different, being three or four closely-packed threads. Aperture wide; varix taller and broader than the ribs; seven small denticles within the outer lip; sinus small and semicircular; canal short and wide. Length 11 mm., breadth 4 mm.

*Hab.* Queensland:—Beach, Murray Island (type, self).

*PSEUDODAPHNELLA BARNARDI* *Brazier.*

(Plate Iv., fig. 178.)

*Clathurella barnardi* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 157.

*Clathurella tessellata* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484.

*Id.* Bonge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 205 (not *Clavatula tessellata* Hinds, Zool. "Sulphur," 1844, p. 23, pl. viii., fig. 17).

*Clathurella chichijimana* Pilsbry, Proc. Acad. Nat. Sci. Philad., 1904, p. 11, pl. i., fig. 7.

? *Clathurella maculosa* Pease, Am. Journ. Conch., iii., 1867, p. 219, pl. xv., fig. 16.

? *Clathurella dichroma* Sturany, Pola Exped., 1903, Moll. p. 252, pl. lxxiii., fig. 5.

The type from the "Chevert" collection, an immature shell, has been compared with the specimen from Murray Island figured here. An earlier misidentification of this Australian shell as *P. tessellata* was based on material received from Père Hervier so named. Both colour varieties, that with black and that with orange spots (var. *luteopicta* Hervier), occur in Queensland. A figure of a shell from the Red Sea is so like ours that I venture to include *C. dichroma* as a probable synonym. If *C. maculosa* Pease should prove, as I suspect, to belong here rather than to *C. felina*, as Tryon indexed it, his name would take precedence.

*Hab.* Queensland:—Barnard Island (type); Eclipse Island; Palm Island (Brazier); Mast Head Island; Murray Island (specimen here figured, self); Facing Island (Kesteven).

PSEUDODAPHNELLA CANISTRA *sp. nov.*

(Plate lv., fig. 179.)

Shell subulate, rather solid. Adult whorls seven. Colour irregularly disposed; on a ground of buff are broad white vertical stripes, a few narrow distant chestnut stripes, and a narrow white peripheral belt. Spiral cords eighteen, radial riblets twenty-two. Aperture:—Within the outer lip are ten small and short plications. Length 10 mm., breadth 3 mm.

Compared with a specimen from Karachi, labelled by its author *Clathurella camarina*,<sup>102</sup> this differs by larger size, more slender shape, and coarser sculpture. A more distant relation is *P. jelinea* Hinds. These can be grouped in a sub-genus *Kermia* Oliver, of which *Clathrina* Melvill is an equivalent.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self); Barney Point; Port Curtis (Kesteven).

PSEUDODAPHNELLA CRASSELIRATA *Hervier.*

(Plate lv., fig. 180.)

*Clathurella albofuniculata* var. *crasselirata* Hervier, Journ. de Conch., xliv., 1897, p. 139, and 1898, p. 92.

*Clathurella tineta* var. *crasselirata* Bouge and Dautzenberg, Journ. de Conch., lxi., 1913 (1914), p. 207.

In view of the confusion that surrounds *Pleurotoma albifuniculata* Reeve, I have preferred to use Hervier's name in a specific sense, a value to which that writer was himself inclined. The example figured is from Torres Strait, and is named by comparison with Hervier's specimens.

*Hab.* Queensland:—Murray Island; 4 to 14 fathoms, Albany Passage (self).

PSEUDODAPHNELLA EPISEMA *Melvill and Standen.*

*Clathurella episema* Melvill and Standen, Journ. of Conch., viii., Nov. 1896, p. 294, pl. x., fig. 38. *Id.* Bouge and Dautzenberg, Journ. de Conch., xli., 1913 (1914), p. 196.

*Clathurella enzonata* Hervier, Journ. de Conch., xliv., April 1897, p. 143, and xlv., 1898, p. 102, pl. ii., fig. 6. *Id.* Tomlin, Journ. of Conch., xiii., 1910, p. 43.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island; Lizard Island (self).

<sup>102</sup> Melvill—Mem. Manchester Lit. Phil. Soc., xlii., 1898, No. 4, p. 13, pl. i., fig. 15.

PSEUDODAPHNELLA DAEDALA *Reeve*.

*Pleurotoma daedala* Reeve, Proc. Zool. Soc., 1846, p. 6. *Id.* Conch. Icon., 1846, pl. xxxviii., fig. 355.

*Clathurella daedala* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 155.

The "Chevert" specimens are 10 mm. long. I doubt if they are correctly determined, but am unable to check this nomenclature.

*Hab.* Queensland:—30 fathoms, Darnley Island (Brazier).

PSEUDODAPHNELLA HARENULA *sp. nov.*

(Plate Iv., fig. 181.)

Shell small, solid, ovate-fusiform, rather turreted and constricted at the base. Colour white, the protoconch buff; on the upper whorls an orange line runs along the second spiral below the angle; on the last whorl such lines follow the third, seventh, and tenth spirals; on the back of the last whorl there may be an irregular orange blotch. Whorls seven, of which three and a half compose the protoconch. Sculpture:—A sub-sutural space representing the fasciole is smooth save for radial wrinkles; the radial ribs are perpendicular and discontinuous, absent on base and fasciole, set at about fourteen to a whorl, and chiefly discernible as knots on the spirals; on the last whorl the spirals amount to fifteen, on the penultimate to six, and on the antepenultimate to four sharp elevated cords. Aperture:—The varix is moderately prominent, and mounts considerably on the penultimate; the inner edge of the lip is beset with ten small crowded denticles; the sinus is spout shaped, constricted at its entrance; the columella terminates anteriorly, and within is a small but distinct tooth. Length 4 mm., breadth 1·7 mm.

This is nearly related to *P. thespesia* Melvill and Standen, but has a whorl less, is smaller, and has stronger, more elevated spirals, which predominate over the radials.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type); 5 to 10 fathoms, Hope Island (self).

PSEUDODAPHNELLA MAYANA *sp. nov.*

(Plate Iv., fig. 182.)

Shell small, lanceolate, subturreted, and rather thin. Colour uniform white or uniform cinnamon, or white spotted with cinnamon. Whorls six, including a two-whorled protoconch. Sculpture:—Variable, according as extra threads are or are not intercalated; radials extending from suture to base and traversing the basal furrow, narrow, discontinuous from whorl to whorl, perpendicular, twelve to fourteen to a whorl; spirals from eleven to fifteen, according to presence or absence of intercalated threads; on the snout six or seven close and knotted threads, then a wide basal furrow followed by from five to eight fine threads which by intersection with the

radials on the peripheral area enclose large meshes; on the upper whorls are from two to four spirals. Aperture open and toothless; varix much thicker than the ribs; sinus very small; canal short and open. Length 6 mm., breadth 2 mm.

In size and general appearance this is like *P. modesta*, for which it has been mistaken.<sup>103</sup> *P. angusta* is a slightly narrower shell, with more numerous and much more slender spirals and radials. Where an interstitial thread has not interfered, the basal furrow of *angusta* is a ready recognition mark. *P. modesta* does not occur in Tasmania. Compared with *P. tincta* the Tasmanian shell is smaller, slighter, thinner, and more delicately sculptured.

*Hab.* Tasmania:—Frederick Henry Bay (May).

PSEUDODAPHNELLA MODESTA Angas.

(Plate Iv., fig. 183.)

*Clathurella modesta* Angas, Proc. Zool. Soc., 1877, p. 38, pl. v., fig. 16. *Id.* Sowerby, Proc. Malac. Soc., ii., 1896, p. 28. *Id.* Pritchard and Gatliff, Proc. Roy. Soc. Viet., xii., 1900, p. 176. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii., 1909, p. 310.

As is frequently the case in this genus, this species has a light and a dark colour dimorphism. A brown specimen in the British Museum, presented by G. F. Angas, is marked there as the type.

*Hab.* N. S. Wales:—Port Jackson (type, Brazier); 100 fathoms, off Port Macquarie; Wreck Bay; Twofold Bay (sell). Victoria:—Port Phillip; Western Port (Pritchard and Gatliff). South Australia:—40 fathoms, Beachport; St. Vincent Gulf; Venus Bay; St. Francis Island (Verco).

PSEUDODAPHNELLA OLIGOTHA *sp. nov.*

(Plate Iv., fig. 184.)

Shell of medium size, rather thin, lanceolate, tumid, with sloping shoulder, perpendicular periphery, and excavate base. Colour uniform pale buff. Whorls seven, including a two-whorled protoconch. Sculpture:—Radials discontinuous from whorl to whorl, feeble and oblique on the shoulder, prominent and perpendicular on the peripheral area, and traversing the basal excavation, widely spaced, ten on the last whorl; spirals slighter than the radials; on the fasciole area of the last whorl are three faint and narrow threads; from the shoulder to the basal angle are five cords, which over-ride the ribs and thus enclose a series of oblong and nearly uniform meshes; on the snout are six crowded and progressively diminishing beaded spirals; the upper whorls carry four spirals; within the meshes are fine radial striae; the basal furrow is spaced as if a spiral

<sup>103</sup> Tate and May—Proc. Linn. Soc. N.S.W., xxvi., 1901, p. 370.

of regular sequence to the rest were omitted. Aperture unusually wide; varix prominent, more massive than the ribs; sinus shallow; canal bent, short, and open. Length 7 mm., breadth 3 mm.

This species has a general resemblance to *P. spelaeodes* Hervier, from New Caledonia, but is smaller, thinner, less cylindrical, and with fewer radials and spirals, resulting in larger meshes in the sculpture.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self).

*PSEUDODAPHNELLA PHILIPPINENSIS* Reeve.

(Plate Iv., fig. 185.)

*Pleurodonta philippinensis* Reeve, Proc. Zool. Soc., 1843, p. 184, and Conch. Icon., i., 1843, pl. xiii., fig. 109.

*Mangilia philippinensis* Melvill and Standen, Journ. of Conch., viii., 1895, p. 94.

*Pseudodaphnella philippinensis* Boettger, Nachr. Malak. Gesell., xxvii., 1895, p. 59.

*Clathurella philippinensis* Hervier, Journ. de Conch., xliv., 1897, p. 138, and xlv., 1898, p. 89. *Id.* Hidalgo, Revist. Acad. Madrid, i., 1904, p. 342. *Id.* Conturier, Journ. de Conch., lv., 1907, p. 13. *Id.* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 438. *Id.* Bouge and Dautzenberg, Journ. de Conch. lxi., 1904, p. 200.

This species is the type of the genus *Pseudodaphnella*. Hervier has already noticed that it is subject to considerable variation in size, disposition of colour, number of radial ribs, and density of spiral cords. On the last whorl of an example from Cape Grenville I counted thirty-four spirals. The apex (Pl. Iv., fig. 185) of a shell I gathered alive at Murray Island is small, brown, and of two whorls, the first finely spirally grooved, the second with numerous close fine radial riblets.

*Hab.* Queensland:—13 fathoms, Cape Grenville (Brazier); Murray Island; Palm Island; Eagle Island; Lizard Island; Three Isles and Two Isles, off Cape Flattery (self).

*PSEUDODAPHNELLA PUNCTIFERA* Garrett.

*Clathurella punctifera* Garrett, Proc. Acad. Nat. Sci. Philad., 1873, p. 222, pl. ii., fig. 2. *Id.* Tryon, Man. Conch., vi., 1884, p. 293, pl. xix., fig. 74. *Id.* Bouge and Dautzenberg, Journ. de Conch. lxi., 1913 (1914), p. 201.

*Mangilia chrysolitha* Melvill and Standen, Journ. of Conch., viii., 1896, p. 286, pl. ix., fig. 25, and 1897, p. 400.

Upon the assurance of Tryon that the figure of *C. punctifera* is defective, I follow Bouge and Dautzenberg in giving it precedence over *M. chrysolitha*. According to the figure of *P. pustulosum*,<sup>104</sup> that species

<sup>104</sup> de Folin—Les Meleagrinicoles, 1867, p. 56, pl. v., fig. 14.

seems to be more slender, with more whorls and with closer and finer spirals anteriorly. *Clathurella radiodis* von Martens, 1880, is much larger and comparatively broader.

*Hab.* Queensland:—Murray Island (self).

PSEUDODAPHNELLA PUNICEA *sp. nov.*

(Plate lv., fig. 186.)

Shell small, solid, ovate-lanceolate, acuminate. Whorls seven, including a two-whorled protoconch. Colour uniform lilac. Sculpture:—Stout perpendicular ribs extending from the shoulder to the base are set at thirteen to a whorl, about their own breadth apart: the spirals are three or four on the upper whorls, and nine on the last: a bead occurs where a spiral intersects a rib, and on the snout, where the radials do not otherwise appear, the small close spirals are still beaded. Aperture wide; varix massive: four denticles within the outer lip. Length 5.5 mm., breadth 2.5 mm.

This species also extends to New Caledonia, whence it has been reported by several writers<sup>105</sup> as *Clathurella blanfordi* Nevill. But that African species is shown by Nevill's original figure<sup>106</sup> to possess a basal furrow double the breadth of that of the Australian shell.

*Hab.* Queensland:—Palm Islands (type); Two Isles and Rocky Isle, off Cape Flattery (self).

PSEUDODAPHNELLA PUSILLATA *Angas.*

(Plate lvi., fig. 187.)

*Clathurella pusillata* Angas, Proc. Zool. Soc., 1877, p. 38, pl. v., fig. 14 (not *Pleurotoma pusillatum* de Folin, 1867).

In the British Museum one specimen from Port Jackson, presented by G. F. Angas, is marked as the type.

*Hab.* N. S. Wales:—Port Jackson (Brazier).

PSEUDODAPHNELLA RAMSAYI *Brazier.*

(Plate lvi., fig. 188.)

*Clathurella ramsayi* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 157.

*Id.* Hedley, Rec. Austr. Mus., iv., 1901, p. 122.

A peculiar wide basal furrow groups *P. ramsayi* with such species as *P. alba* Deshayes, *blanfordi* Nevill, *cavernosa* Reeve, *leuckarti* Dunker, *mayana* Hedley, *oligoina* Hedley, *spelaeodea* Hervier, *stipata* Hedley, and *tincta* Reeve.

<sup>105</sup> Bouge and Dautzenberg—Journ. de Conch., lxi., 1913 (1914), p. 192.

<sup>106</sup> Nevill—Journ. Asiat. Soc. Bengal, xliv., 1875, pl. vii., fig. 14.



Because its label had been left blank this species was formerly reported as missing from the "Chevert" collection, but on a second and closer examination a type label was found concealed in the bottom of the box enclosing the specimen. By aid of the type thus recovered, and now figured, I can trace this Papuan species along the Queensland coast. Australian specimens are a little larger and slightly different in colour, and as the original description is rather brief, I add a description of the shells from Lady Elliot Island.

Shell small, glossy, rather solid, subcylindrical, and constricted at the base. Colour white, with two narrow orange-brown zones, the first immediately below the suture and ascending the upper whorls, the second running above the basal furrow and ending on the varix. Sculpture:—The ribs are continuous and perpendicular, set eleven to a whorl, wider than their breadth apart; the spirals are four on the upper whorls, and nine on the last; of these two small coloured threads run close together beneath the suture, and are followed by three thick wide-spaced uncoloured cords on the periphery, then by a coloured cord of equal calibre; below that is a massive spiral, and lastly two small bead rows set close together on the extremity of the spout; the meshes on the periphery are rather deep, oblong, and translucent. Aperture wide; varix prominent, and much larger than the ribs; within the outer lip are four small denticles; sinus small; canal short and broad. Length 6.3 mm., breadth 3 mm.

*Hab.* New Guinea:—4 fathoms, Katow (type, "Chevert"). Queensland:—Lady Elliot Island (Miss Lovell); Facing Island, Port Curtis (Kesteven). Western Australia:—Cottesloe (Henn).

*PSEUDOPHANELLA RETELLARIA* *sp. nov.*

(Plate lvi., fig. 189.)

*Published by* *Dr* Brazier, Proc. Linn. Soc. N.S.W., i., 1876, p. 154 (not *Ph. ornata* *Reeve*, Conch. Icon., i., 1845, pl. xxix., fig. 257).

Shell small, lanceolate, subturreted, thin. Colour dull white, with a few brown spots on the shoulder, and the apex brown. Whorls eight, including a protoconch of three and a half whorls. Sculpture harsher on the earlier whorls; radials narrow, almost lamellate, ending abruptly at the shoulder and gradually on the base, slightly oblique, widely spaced, on the last whorl fourteen, and on the penultimate sixteen; these are crossed by spiral threads of smaller gauge, forming long narrow meshes, amounting to sixteen on the last whorl and to six on the penultimate; fasciæ flat, only incised by crescentic growth lines. Aperture ovate; outer lip forming a small varix, ascending the previous whorl and enclosing a C-shaped sinus; lip dentate at the margin and tuberculate within; canal short and wide. Length 6 mm., breadth 2.3 mm.

From *P. melanocephala* Hervier this differs by larger size, more slender form, and by a sculpture composed of threads rather than beads.

*Hab.* Queensland:—15 fathoms, Palm Island (type); 5 to 6 fathoms, Murray Island (self); 20 fathoms, Daruley Island (Brazier)

## PSEUDOLAPHNELLA RUFOZONATA Angas.

(Plate lvi., fig. 190.)

*Clathurella rufozonata* Angas, Proc. Zool. Soc., 1877, p. 38, pl. v., fig. 13.  
*Id. op. cit.*, 1880, p. 415. *Id.* Verco, Trans. Roy. Soc. S.A., xxxiii.,  
 1909, p. 311.

In the British Museum are six shells from Port Jackson, presented by G. F. Angas, and marked as the types of this species. The colour markings are irregularly disposed, or may be absent.

By G. B. Sowerby<sup>107</sup> this species was united to *P. tinctoria* Reeve, and to *P. albifuniculata* Reeve, an arrangement copied by Pritchard and Gatliff.<sup>108</sup> But *P. rufozonata* is only two-thirds the height of *tinctoria*, is of a more slender build, and lacks the peculiar excavate base of that tropical species. The latter feature is shown in Reeve's figure, and is mentioned by Hervier<sup>109</sup> as the "dépression circulaire autour de son canal basal." The records by Melvill and Standen<sup>110</sup> and by Bouge and Dautzenberg<sup>111</sup> of *rufozonata*, from the Loyalty Islands, are doubtless due to the confusion between this and *P. tinctoria*. *P. rufozonata* is indeed more nearly related to *albifuniculata* Reeve, but is smaller, more fusiform, and has the radials more prominent owing to the spirals being slighter. A more distant relation is *P. barnardi*, easily separable by the heavier sculpture and striking colour pattern.

*Hab.* N. S. Wales:—Bottle and Glass Rocks, Port Jackson (type, Brazier); Catherine Hill Bay (Cherry).

## Var. TRACHYS Tenison-Woods.

*Mangelia trachys* Tenison-Woods, Trans. Roy. Soc. Vict., xiv., 1878, p. 57.

This western form seems to be slightly larger and to be more highly coloured than the typical eastern *rufozonata*, so the name of Tenison-Woods may serve to express a geographical race.

*Hab.* Victoria:—Brighton (type, Melbourne Museum); Western Port and Polwarth (Pritchard and Gatliff). South Australia:—Hardwick Bay (Matthews).

## Var. NODORETE May.

*Clathurella nodorete* May, Proc. Roy. Soc. Tasm., 1915, p. 84, pl. i., fig. 4.

This southern form differs slightly by a rather larger protoconch, and by less prominent sculpture.

*Hab.* Tasmania:—80 fathoms, Schouten Island (type, May).

<sup>107</sup> Sowerby—Proc. Malac. Soc., ii., 1896, p. 28.

<sup>108</sup> Pritchard and Gatliff—Proc. Roy. Soc. Vict., xii., 1900, p. 176.

<sup>109</sup> Hervier—Journ. de Conch., xlv., 1897, p. 92.

<sup>110</sup> Melvill and Standen—Journ. of Conch., viii., 1897, p. 403.

<sup>111</sup> Bouge and Dautzenberg—Journ. de Conch., lxi., 1914, p. 204.

*PSEUDODAPHNELLA STIPATA* *sp. nov.*

(Plate lvi., fig. 191.)

Shell small, solid, broad in proportion to length. Adult whorls about four. Sculpture:—The radials are prominent spaced ribs, set about ten to a whorl; the spirals are strong cords, two on the antepenultimate, three on the penultimate, and seven on the last whorl; on the latter the third spiral from the suture runs into the top of the varix, between the fourth and the fifth is a wide gap, and the last three are tubercular and traverse the snout. Aperture:—The varix is very thick and prominent; the sinus is small and shallow. Length 4 mm., breadth 2 mm.

This sturdy little species is somewhat like *Pleurotoma alba*,<sup>112</sup> but is shorter, comparatively stouter, with fewer but more prominent cinguli. In the hollow of the base a spiral is missing, producing the effect of a broad furrow interrupted by the radials, as in *P. spelaeodea* Hervier and *P. lineata* Reeve. The only three specimens that I dredged are dead and faded, so that details of colour and apex are not available.

*Hab.* Queensland:—4 to 14 fathoms, Albany Passage (type, self).

*PSEUDODAPHNELLA TESSELLATA* *Hinds*.

(Plate lvi., figs. 192-193.)

*Clavatula tessellata* Hinds, Proc. Zool. Soc., 1843, p. 44, and Zool. "Sulphur," ii., 1844, p. 23, pl. vii., fig. 17 (not *Pleurotoma tessellata* Reeve, Conch. Icon., i., 1845, pl. xxvii., fig. 244, err. on pl. "344"; nor *Pleurotoma tessellata* Reeve, Conch. Icon., i., 1846, pl. xxxvi., fig. 331=*P. formosus* Reeve; nor *P. tessellata* of subsequent authors).

*Pleurotoma forbesii* and *Pleurotoma apicalis* Montrouzier, Journ. de Conch., ix., 1861, p. 277, pl. xi., fig. 6.

*Clathurella apicalis* Hervier, Journ. de Conch., xlv., 1896, p. 143. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 192.

? *Defrancia mauritiana* Sowerby, Proc. Zool. Soc., 1893, p. 491, pl. xxxviii., figs. 23, 24.

This species appears to have suffered general neglect, and its name to have been misappropriated. The above figure is from a specimen that I collected in Torres Strait.

*Hab.* Queensland:—Murray Island; Palm Island (self).

<sup>112</sup> Deshayes—Moll. de Reunion, 1863, p. 110, pl. xli., figs. 17, 18.

## PSEUDODAPHNELLA TINCTA Reeve.

*Pleurotoma tincta* Reeve, Conch. Icon., i., 1846, pl. xxxviii., fig. 347, and Proc. Zool. Soc., 1846, p. 5.

*Clathurella tincta* Pease, Am. Journ. Conch., iv., 1868, p. 105. *Id.* Langkavel, Donum Bismarekianum, 1871, p. 1. *Id.* Tryon, Man. Conch., vi., 1884, p. 292, pl. xvi., fig. 76. *Id.* Melvill and Standen, Journ. of Conch., xviii., 1897, p. 403. *Id.* Hervier, Journ. de Conch., xlv., 1897, p. 138, and xlv., 1898, p. 90. *Id.* Sturany, Pola Exped., 1903, Moll. p. 251, pl. vii., fig. 1. *Id.* Hedley, Proc. Linn. Soc. N.S.W., xxxii., 1907, p. 484. *Id.* Bouge and Dautzenberg, Journ. de Conch., lxi., 1914, p. 206. *Id.* Melvill and Standen, Proc. Zool. Soc., 1901, p. 466.

*Clathurina tincta* Melvill, Proc. Malac. Soc., xii., 1917, p. 188.

*Defrancia corrugata* Schmeltz (*nomen nud.*), Mus. Godeffroy, Cat., iv., 1869, p. 90.

*Clathurella corrugata* Dunker, Malak. Blatt., xviii., 1871, p. 159, *jide* Garrett in Tryon.

*Clathurella rubroguttata* H. Adams, Proc. Zool. Soc., 1872, p. 14, pl. iii., fig. 25. *Id.* Thurston, Madras Museum Bulletin, iii., 1895, p. 122.

*Clathurella centrosa* Pilsbry, Proc. Acad. Nat. Sci. Philad., 1904, p. 11, pl. i., fig. 6.

The type of *C. rubroguttata* from the Hargraves collection is preserved in the Australian Museum. It seems to me to be the typical form of *P. tincta*. Perhaps a smaller more closely latticed form that occurs also on the Australian coast may be distinguished as var. *corrugata*.

*Hab.* Queensland:—5 to 10 fathoms, Hope Island; Two Isles, off Cape Flattery; Lizard Island; Murray Island; Mapoon; Mornington Island (self).

## EUCYCLOTOMA Boettger.

*Eucyclotoma* Boettger, Nachr. Malak. Gesell., xxviii., 1895, p. 55. Type *Daphnella fusiformis*.

From *Daphnella* this genus is distinguished by a spirally striated nucleus. On the adult whorls the spiral sculpture develops into prominent keels. Its members are chiefly associated with a coral reef fauna.

Besides the type the founder included in his genus *Pleurotoma tricarinata* Kiener and *Clathurella bicarinata* Pease. Addition of the following is now suggested:—*Pleurotoma lactea* Reeve, *P. hiadsii* Reeve, *P. inquinata* Reeve, *P. carinulata* Sowerbie, *Daphnella varicifera* Pease, and *D. tricaricosa* von Martens.

EUCYCLOTOMA CARINULATA *Souverbie*.

*Pleurotoma carinulata* Souverbie, Journ. de Conch., xxiii., 1875, p. 289, pl. xiii., fig. 6. *Id.* Boettger, Nachr. Malak. Gesell., 1895, p. 62.

From the figure this species seems related to *fusiformis* Garrett and *caricifer* Pease. Hitherto it has only been recorded from New Caledonia.

*Hab.* Queensland:—Murray Island: Two Isles, off Cape Flattery; Palm Island: 17 to 20 fathoms, Mast Head Island (self); Eclipse Island (Brazier). N. S. Wales:—Norah Head (Hargraves Collection).

EUCYCLOTOMA EXILIS *Dunker*.

*Purpura (Polytrupa) exilis* Dunker, Mal. Blatt., xviii., 1871, p. 154. *Id.* Tryon, Man. Conch., vi., 1884, p. 289.

*Pleurotoma tricarinata* Reeve, Conch. Icon., i., 1843, pl. xv., fig. 12 (not *Pleurotoma tricarinata* Kiener).

*Clathurella pulcherrima* H. Adams, Proc. Zool. Soc., 1872, p. 12, pl. iii., fig. 26.

*Hab.* Queensland:—5 fathoms, Murray Island (self).

EUCYCLOTOMA NOBILIS *sp. nov.*

(Plate lvi., figs. 194, 195.)

Shell large for the genus, lanceolate, rather solid. Colour crystalline white, splashed irregularly with orange buff; nucleus buff. Besides a two-whorled mucronate nucleus there are about seven whorls which wind obliquely and are girt with solid projecting keels. The turreted spire is a little longer than the last whorl. Sculpture:—On the last whorl are four nearly equal girdles; the second and fourth diminish as they ascend, and vanish in a thread two whorls above; the keel forming the basal angle just emerges above the suture on the upper whorls; close set perpendicular riblets bead the keels at the point of intersection, and their interstices are again traversed by smaller spiral threads; on the snout are half-a-dozen spirals; one specimen has a perfect varix half a whorl behind the mouth; the nucleus has close spiral threads reticulated by finer radials. Aperture:—Outer lip flared, its edge dentate by the girdle ends, and roughened by intermediate wrinkles; sinus subsutural, ovate, contracted at the entrance; canal short and bent; columella excavate above and twisted below; inner lip represented by a thin film of callus. Length 16 mm., breadth 7 mm.

This comes nearest to *E. bicarinata*,<sup>113</sup> from the Gilbert Archipelago, but our shell at a corresponding length has three keels instead of two,

<sup>113</sup> Pease—Am. Journ. Conch., iii., 1867, p. 222, pl. xv., fig. 23.

and less sloping shoulders. Some young shells which I dredged in Torres Straits I suppose, but not with confidence, to be the same species as that from the Coral Sea.

*Hab.* Bird Islet, Wreck Reef: Coral Sea, lat. 22.10 S., long. 155.28 E. (type, Australian Museum). Queensland:—4 to 14 fathoms, Albany Passage; 5 to 8 fathoms, Murray Island (self).

#### DAPHNELLOPSIS *Schepman*.

*Daphnellopsis* Schepman, Siboga Exped. Monogr., xlix., 1913, p. 449. Type *D. lamellosa* Schepman, *op. cit.*

The unusual contour of an expanded peristome and varix renders this genus noticeable, and easily distinguishable from others of the Turridæ. Probably *Clathurella obesa*<sup>114</sup> should be here included.

#### DAPHNELLOPSIS MUREX *sp. nov.*

(Plate lvi., figs. 196, 197, 198.)

Shell small, rather thin, ovate-fusiform. Colour of dead specimen uniform dull white. Including the protoconch the whorls are four. Protoconch involute, small, obliquely tilted, finely spirally grooved. Sculpture:—Radial riblets cross the full breadth of the whorl, above sharp and more closely set, on last whorl fainter, lower, and wider; about fifteen to a whorl; varices irregular, two on the last and one on the penultimate whorl, lamellate, expanded, and having a general resemblance to those of *Murex trifornis*; the spiral threads are about twenty on the last whorl, and about eight on the penultimate; fasciole indeterminate. Aperture:—Mouth elliptical; sinus subtrubular; canal moderately produced, slightly bent, and nearly closed. Length 5.5 mm., breadth 2 mm.

*Hab.* Queensland:—5 to 8 fathoms, Murray Island (type, self).

#### TELEOCHILUS *Harris*.

*Teleochilus* Harris, Cat. Tert. Moll. Brit. Mus., i., 1897, p. 64. Type *Daphnella gracillima* Tenison-Woods. *Id.* Tate, Journ. Roy. Soc. N.S.W., xxxi., 1897, p. 393. *Id.* Cossman, Essai Pal. Comp., iii., 1899, p. 191, and vii., 1906, p. 224. *Id.* Dall, Proc. U.S. Nat. Mus., liv., 1918, p. 332.

The genotype is a Tertiary fossil from Tasmania and Victoria, and the genus is hitherto unknown as recent. Several writers have expressed doubts whether *Teleochilus* may be properly included in the Turridæ. My own suggestion is that it may be a toothless member of the Acteonidæ near *Bullinula*.

<sup>114</sup> Garrett—Proc. Acad. Nat. Sci. Philad., 1873, p. 221, pl. ii., fig. 36.

*TELEOCHILUS BICONICUM Hedley.*

(Figure 14.)

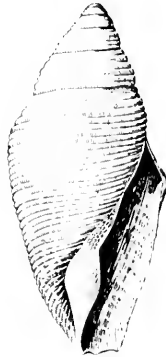
*Bathytoma biconica* Hedley, Mem. Austr. Mus., iv., 1903, pp. 385, fig. 98.*Hab.* N. S. Wales :—20 fathoms, Shoalhaven Bight ("Thetis").

Fig. 14

*TELEOCHILUS SARCINULUM Hedley.*

(Figure 15.)

*Bathytoma sarcinula* Hedley, Rec. Austr. Mus., vi., 1905, p. 53, fig. 21.*Hab.* N. S. Wales :—111 fathoms, Cape Byron (type, Halligan).  
Tasmania :—Bass Straits (Gatliff).

Fig. 15.

NEW NAMES ARE PROPOSED IN THIS PUBLICATION AS  
FOLLOWS:

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GENERIC and SUBGENERIC.

*Accista*, *Anacithara*, *Asperdaphne*, *Filodrillia*, *Heterocithara*, *Leiocithara*,  
*Marita*, *Mitrithara*, *Seriniina*, *Splendrillia*, *Turridrupa*.

SPECIFIC and SUBSPECIFIC.

*Anacithara brevicostata*, *calatura*, *exquisita*, *hebes*, *herrieri*, *leptalea*, *propinqua*, *rissoina*, *robusta*, *stricta*, *tumida*.

*Asperdaphne amplexa*, *bela*, *capricornea*, *compacta*.

*Asthacotoma cicatrigula*, *steira*.

*Austrodrillia raritensis*.

*Clarus aeneus*, *candidulus*, *costatus*.

*Daphnella costum*, *chererti*, *granata*, *signastoma*.

*Daphnelopsis murex*.

*Epidreia gabensis*, *torquata*.

*Etrema acricula*, *capillata*, *catapasta*, *calmen*, *curtisiana*, *elegans*, *firma*,  
*lobiosa*, *ocirufa*, *polydesma*, *rarella*, *sparula*, *tortilabia*.

*Eucithara alacris*, *arenivaga*, *brocha*, *minutalia*, *monochoria*, *moraria*,  
*miriamica*, *phyllidis*.

*Eucylotoma nobilis*.

*Filodrillia columnaria*, *macronata*, *ocnata*, *stadialis*.

*Gemma lombrovi*.

*Guraleus costatus*, *costatus wilesianus*, *fascinus*, *fascinus stephensi*, *morologus*,  
*nitidus*, *permutatus*.

*Hamilienardia hersilia*, *homochroa*.

*Heterocithara concinna*, *crismata*, *seriola*, *transenna*.

*Inquisitor coriorundis*, *fibriatus*, *flindersianus*, *formidabilis*, *granobalteatus*,  
*hercetosis*, *laxulus*, *petilius*, *sparius*.

*Liencardia corticea*, *fallaciosa*, *farsilis*, *falsaria*, *gracilis*, *periscelina*, *punctilla*,  
*calla*, *rosella*.

*Macteola segesta cinctura*.

*Melatomia eburnea*, *dampieria*, *duplaris*, *lygdina*, *spadicina*.

*Mitrithara columnaria*, *probes*.

*Nepotilla tropicalis*.

*Paracatharella aditicola*, *clothonis*.

*Pseudodaphnella attenuata*, *canistra*, *harcaula*, *mayana*, *oligoina*, *punicea*,  
*retellaria*, *stipata*.



*Pseudoraphitoma* *aricula*, *hippyramidata*, *crudebris*, *informis*, *styracina*, *transitans*.

*Scrinium* *furtivum*.

*Turridrupa* *deceptrix*, *pertinax*.

*Veprecula* *scala*, *vacillata*, *vacillata paucicostata*.

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#### ADDENDA AND CORRIGENDA.

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Page 221, line 41—for *parabola* read *parabola*.

Page 225, line 18—Lieut.-Colonel A. J. Peile has lately published (Proc. Malac. Soc., xv., 1922, pp. 18, 19, fig. 1) a new figure of the radula of *Columbarium*. He withdraws this genus from the Turridæ and refers it to the Rachiglossa near the Muricidæ. He also unites *C. pagodoides* Watson to *C. spinicincta* Watson.

Page 225, line 37—The date of *Fusus pagodoides* is not 1881, but June 12th, 1882.

Page 231, line 18—For XANTHOPHÆS read XANTHOPHÆS.

Page 244—Delete lines 8 to 10. This figure is from the type.

Page 249, line 27—For SUBPLICATA read SUBPLICATA.

Page 255, line 22—For *Strombus* read *Strombus lividus*.

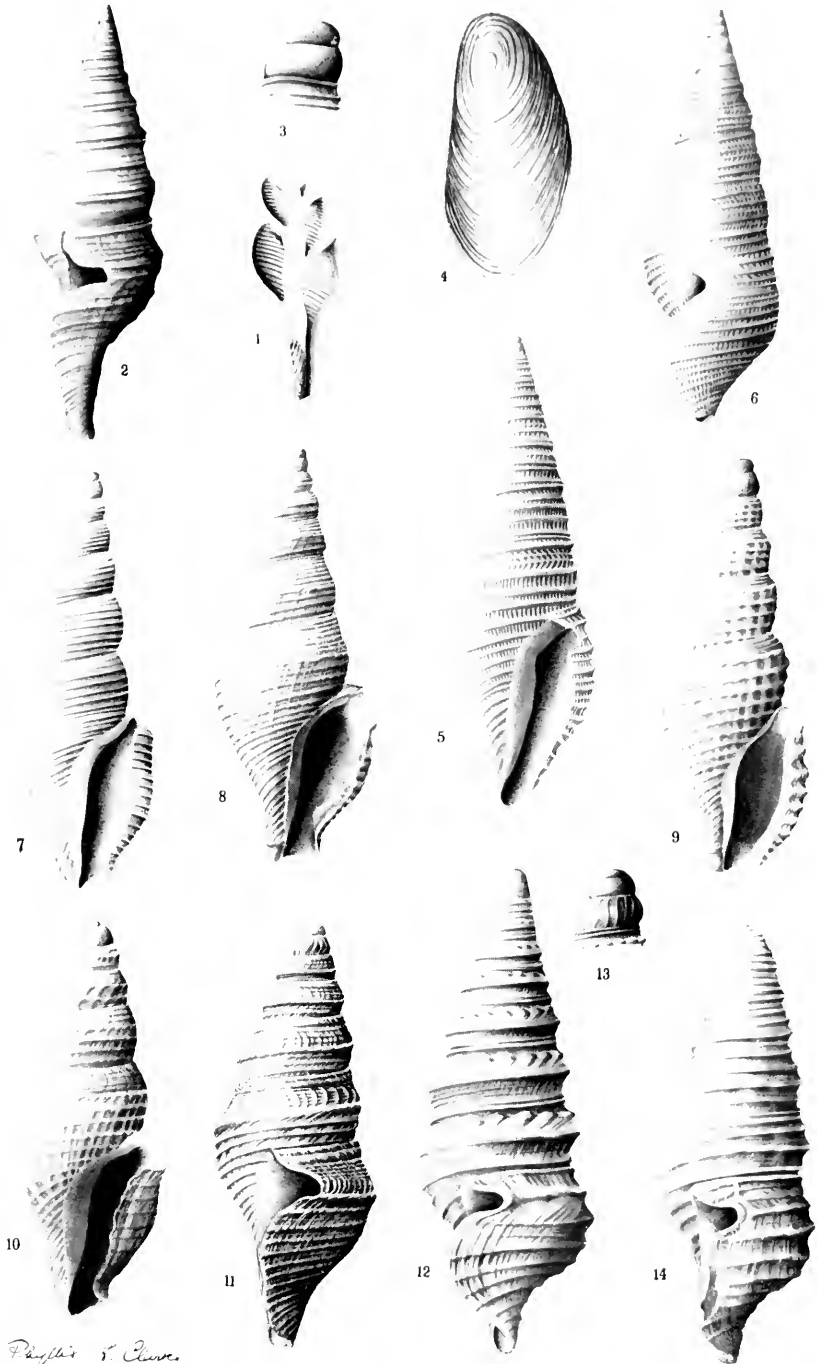




EXPLANATION OF PLATE XLII.

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- Fig. 1. *Turris babylonica* Linne. Woodlark Island. Section to show  
fluted interior of whorls.
- .. 2. *Turris marmorata* Lamarek. Starcke River, Queensland.
- .. 3. .. Apex. Eagle Island, Queensland.
- .. 4. *Asthenotoma nireu* Philippi. Operculum. Karachi, India.
- .. 5. .. *cicatrigula* Hedley. Type.
- .. 6. .. *subtilinea* Hedley. Type.
- .. 7. *Filodrillia columnaria* Hedley. Type.
- .. 8. .. *macromata* Hedley. Type.
- .. 9. .. *ornata* Hedley. Type.
- .. 10. .. *stadialis* Hedley. Type.
- .. 11. .. *steira* Hedley. Type.
- .. 12. *Turridrupa acatigemmata* Smith. Hope Island, Queensland.
- .. 13. .. Apex.
- .. 14. .. *deceptrix* Hedley. Type.



*Phyllis S. Jones*





EXPLANATION OF PLATE XLIII.

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- Fig. 15. *Turridrupa pertinax* Hedley. Type.  
 .. 16. *Epidelira gabensis* Hedley. Type.  
 .. 17. .. *philippineri* Tenison-Woods. N. W. Tasmania.  
 .. 18. .. *striata* Gray. Port Jackson.  
 .. 19. .. .. Apex.  
 .. 20. .. .. Operculum.  
 .. 21. .. *torquata* Hedley. Type.  
 .. 22. *Mitriothara alba* Petterd. Flinders, Victoria.  
 .. 23. .. *columnaria* Hedley. Type.  
 .. 24. .. *proles* Hedley. Type.  
 .. 25. *Inquisitor coriorudis* Hedley. Type.  
 .. 26. .. *coci* Angus. Port Jackson.  
 .. 27. .. *fibratus* Hedley. Type.





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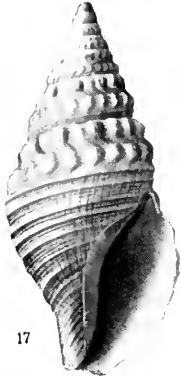
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*Phyllis & Clarke*





EXPLANATION OF PLATE XLIV.

- Fig. 28. *Inquisitor flindersianus* Hedley. Type.  
 .. 29. .. *formidabilis* Hedley. Type.  
 .. 30. .. *granobalteus* Hedley. Type.  
 .. 31. .. *immaculatus* Tenison-Woods. Western Port, Victoria.  
 .. 32. .. *lucertosus* Hedley. Type.  
 .. 33. .. *lussulus* Hedley. Type.  
 .. 34. .. *metcalfei* Angus. Port Jackson.  
 .. 35. .. .. Operculum.  
 .. 36. .. *petilius* Hedley. Type.  
 .. 37. .. *suavis* Smith. Off Cape Three Points, N. S. Wales.  
 .. 38. *Anstrodrillia angasi* Crosse. Port Jackson.  
 .. 39. .. .. Operculum.



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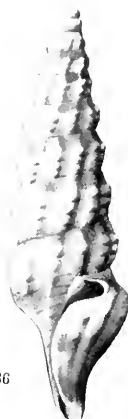
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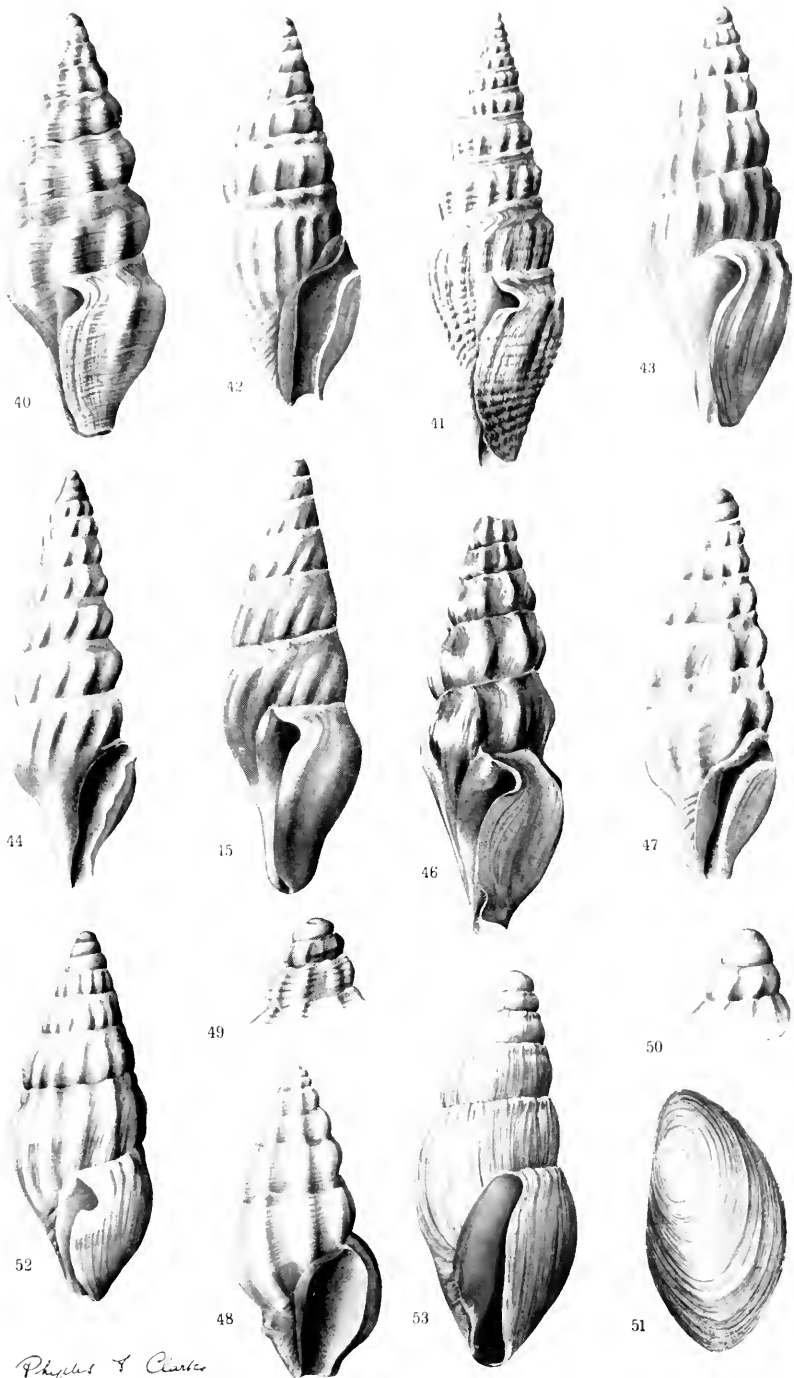




EXPLANATION OF PLATE XLV.

- Fig. 40. *Austrodrillia heraudiana* Crosse. Port Jackson.
- .. 41. *Melatoma dampieria* Hedley. Type.
- .. 42. .. *dupluris* Hedley. Type.
- .. 43. .. *eburnea* Hedley. Type.
- .. 44. .. *lygdina* Hedley. Type.
- .. 45. .. *spadicina* Hedley. Type.
- .. 46. *Cluvus inens* Hedley. Type.
- .. 47. .. *candidulus* Hedley. Type.
- .. 48. .. *costatus* Hedley. Type.
- .. 49. .. .. Apex.
- .. 50. .. *exasperatus* Reeve. Apex. Hope Island, Queensland.
- .. 51. .. *viduus* var. *viduoloides* Garrett. Operculum. Cebu, Philippines.
- .. 52. *Iredalea subtropicalis* Oliver. Murray Island, Queensland.
- .. 53. *Serinium furticum* Hedley. Type.





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EXPLANATION OF PLATE XLVI.

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- Fig. 54. *Eucithara alacris* Hedley. Type.  
 .. 55. .. .. Apex.  
 .. 56. .. *areniraga* Hedley. Type.  
 .. 57. .. .. Apex.  
 .. 58. .. *brocha* Hedley. Type.  
 .. 59. .. *caledonica* Smith. Onbatche, New Caledonia.  
 .. 60. .. .. Detail of sculpture.  
 .. 61. .. *guentheri* Sowerby. Cape Grenville, Queensland.  
 .. 62. .. *lyra* Reeve. Annam bar, Queensland.  
 .. 63. .. *monochoria* Hedley. Type.  
 .. 64. .. *moraria* Hedley. Type.  
 .. 65. .. *miriamica* Hedley. Type.  
 .. 66. .. *phyllidis* Hedley. Type.  
 .. 67. .. .. Detail of sculpture.  
 .. 68. .. *striatissima* Sowerby. Murray Island, Queensland.  
 .. 69. *Etrema acricula* Hedley. Type.



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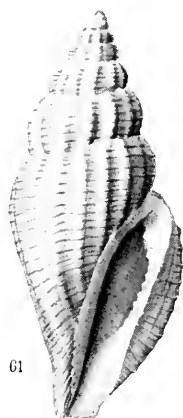
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EXPLANATION OF PLATE XLVII.

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- Fig. 70. *Etrema aliciae* Melvill and Standen. Lifu, Loyalty Islands.  
 .. 71. .. *alphonsiana* Hervier. Lizard Island, Queensland.  
 .. 72. .. *capillata* Hedley. Type.  
 .. 73. .. *catapasta* Hedley. Type.  
 .. 74. .. *culmea* Hedley. Type.  
 .. 75. .. .. Detail of sculpture.  
 .. 76. .. *curtisiana* Hedley. Type.  
 .. 77. .. *elegans* Hedley. Type.  
 .. 78. .. *firma* Hedley. Type.  
 .. 79. .. *glabriplicata* Sowerby. Murray Island, Queensland.  
 .. 80. .. .. Detail of sculpture.  
 .. 81. .. *nassoides* Reeve. Port Jackson.  
 .. 82. .. *ovirufa* Hedley. Type.  
 .. 83. .. *polydesma* Hedley. Type.





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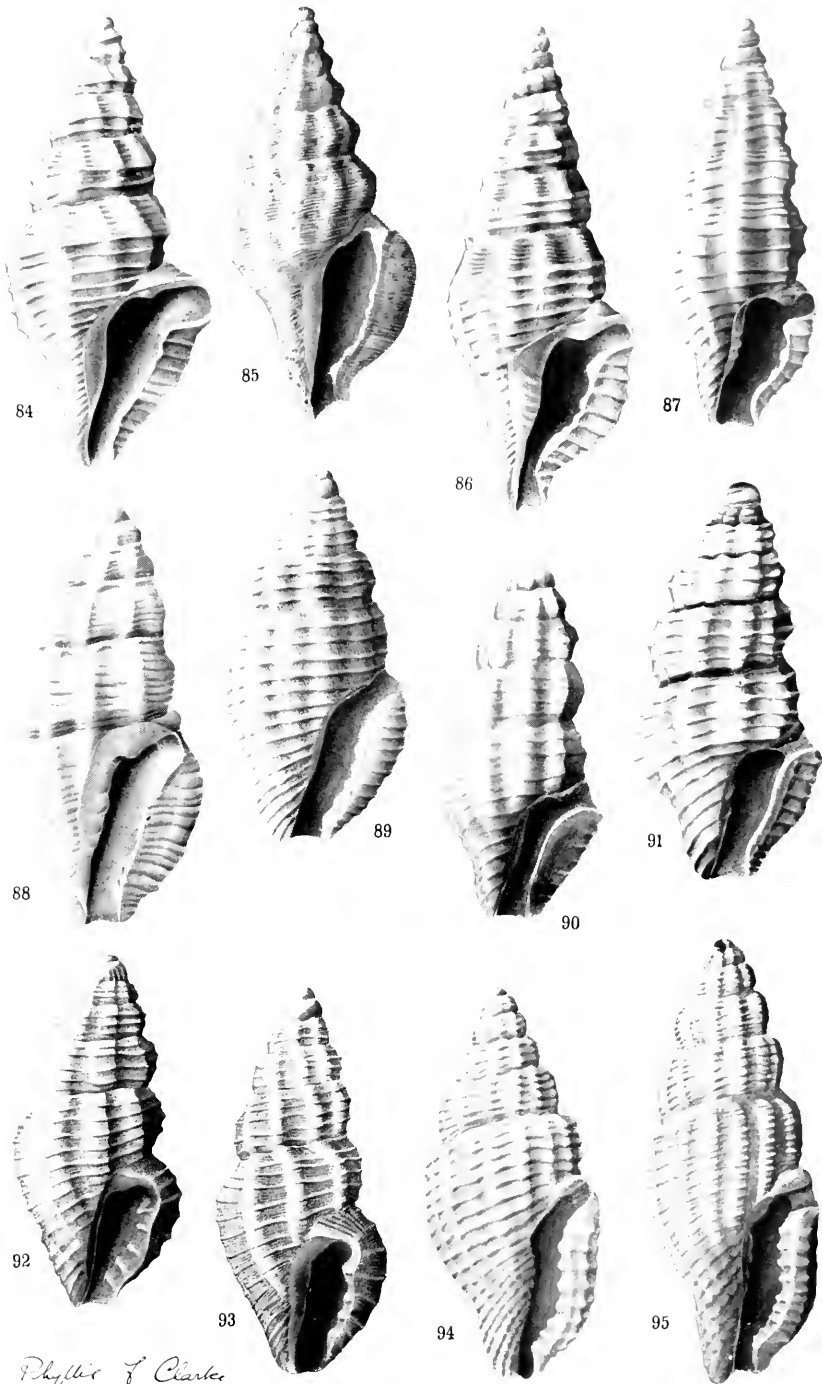




EXPLANATION OF PLATE XLVIII.

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- Fig. 84. *Etrema rarella* Hedley. Type.  
.. 85. .. *spatula* Hedley. Type.  
.. 86. .. *spurea* Hinds. Cairns, Queensland.  
.. 87. .. *tortilabia* Hedley. Type.  
.. 88. *Lienardia falsaria* Hedley. Type.  
.. 89. .. *corticea* Hedley. Type.  
.. 90. .. *fallaciosa* Hedley. Type.  
.. 91. .. *fallax* Nevill. Lifu, Loyalty Islands.  
.. 92. .. *farsilis* Hedley. Type.  
.. 93. .. *gracilis* Hedley. Type.  
.. 94. .. *immaculata* Smith. Norah Head, N. S. Wales.  
.. 95. .. *latea* Pease. Lizard Island, Queensland.



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EXPLANATION OF PLATE XLIX.

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- Fig. 96. *Lienardia mighelsi* Iredale and Toulmin. Tahiti.  
.. 97. .. *multinoda* Hedley. Type.  
.. 98. .. *periscelina* Hedley. Type.  
.. 99. .. *punctilata* Hedley. Type.  
.. 100. .. *colla* Hedley. Type.  
.. 101. .. *rosella* Hedley. Type.  
.. 102. .. *rubida* Hinds. Apex. Milne Bay, Papua.  
.. 103. *Hemilienardia goubini* Hervier. Murray Island, Queensland.  
.. 104. .. *lervilia* Hedley. Type.  
.. 105. .. *homochroa* Hedley. Type.  
.. 106. *Heterocithara bilineata* Angas. Port Jackson.  
.. 107. .. *conciata* Hedley. Type.  
.. 108. .. *crismata* Hedley. Type.





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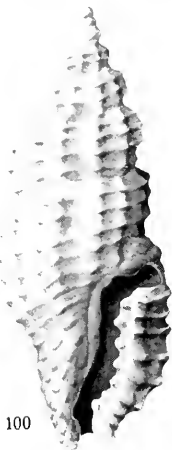
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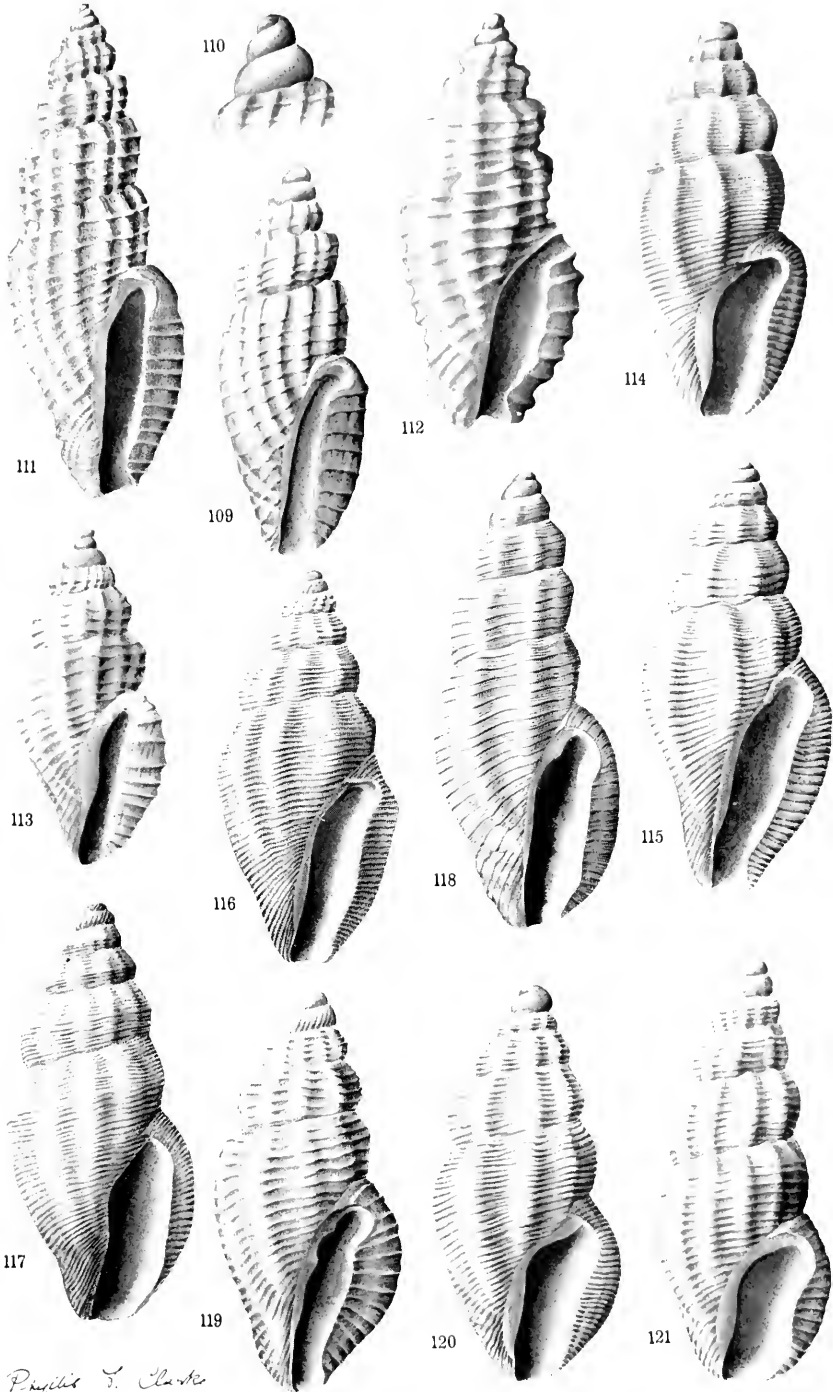




EXPLANATION OF PLATE L.

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- Fig. 109. *Heterocithara rigorata* Hedley. Endeavour Reef, Queensland.  
 .. 110. .. .. Apex.  
 .. 111. .. *seriliola* Hedley. Type.  
 .. 112. .. *transenna* Hedley. Type.  
 .. 113. .. *zebuensis* Reeve. Hope Island, Queensland.  
 .. 114. *Anacithara brevicostata* Hedley. Type.  
 .. 115. .. *calatura* Hedley. Type.  
 .. 116. .. *exquisita* Hedley. Type.  
 .. 117. .. *lebes* Hedley. Type.  
 .. 118. .. *herrieri* Hedley. Type.  
 .. 119. .. *leptalea* Hedley. Type.  
 .. 120. .. *propinqua* Hedley. Type.  
 .. 121. .. *rissoina* Hedley. Type.



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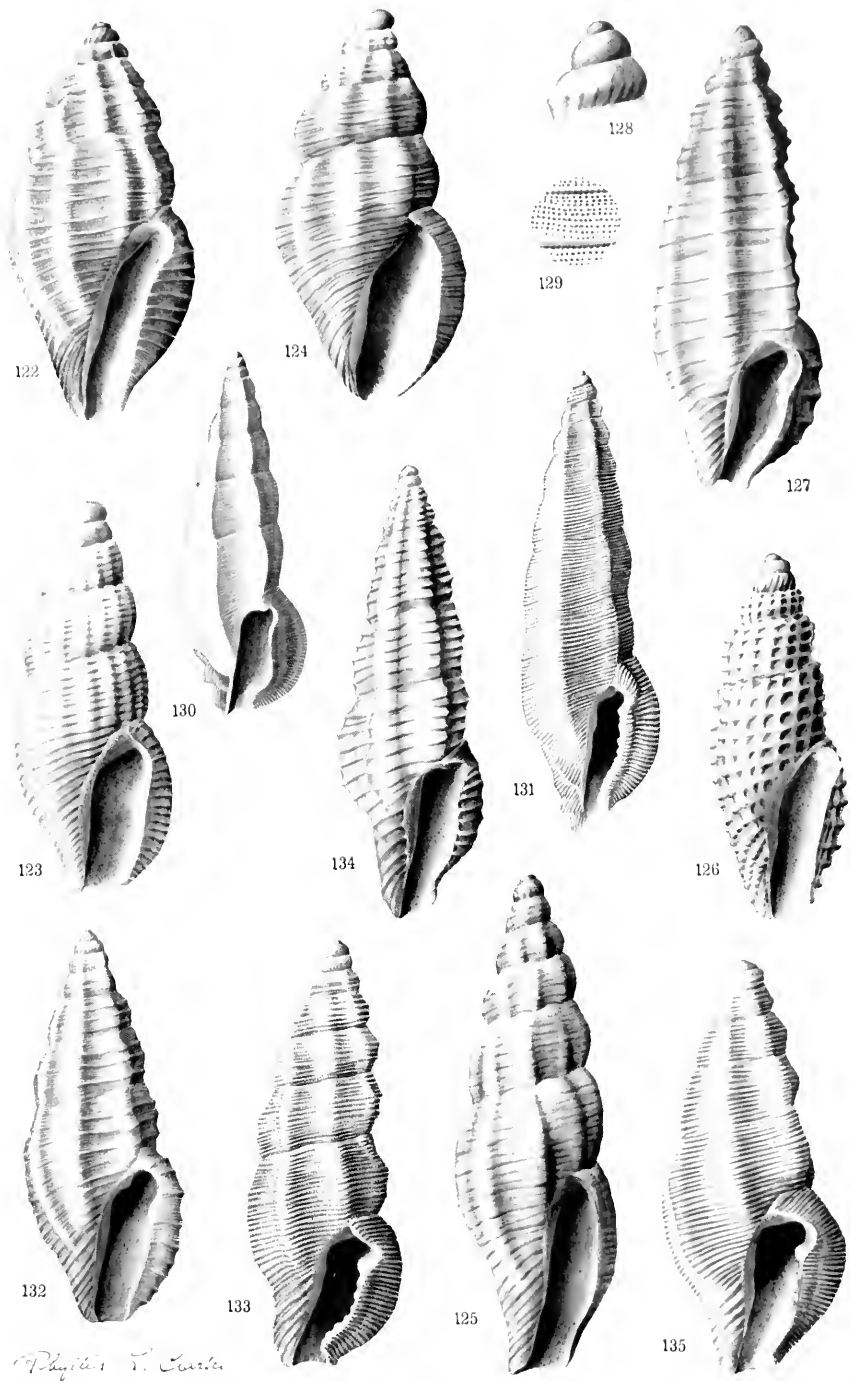




EXPLANATION OF PLATE LI.

- |           |                           |                      |  |
|-----------|---------------------------|----------------------|--|
| Fig. 122. | <i>Anacilhara robusta</i> | Hedley.              | Type.  |
| .. 123.   | ..                        | <i>stricta</i>       | Hedley. Type.                                |
| .. 124.   | ..                        | <i>tumida</i>        | Hedley. Type.                                |
| .. 125.   | <i>Paracilharella</i>     | <i>aditicola</i>     | Hedley. Type.                                |
| .. 126.   | ..                        | <i>clathronis</i>    | Hedley. Type.                                |
| .. 127.   | <i>Pseudorhaphitoma</i>   | <i>fairbanki</i>     | Nevill. Type.                                |
| .. 128.   | ..                        | ..                   | Apex.  |
| .. 129.   | ..                        | ..                   | Detail of Sculpture.                         |
| .. 130.   | ..                        | <i>alticostata</i>   | Sowerby. Neptune Island,<br>South Australia. |
| .. 131.   | ..                        | <i>axicula</i>       | Hedley. Type.                                |
| .. 132.   | ..                        | <i>hippyramidata</i> | Hedley. Type.                                |
| .. 133.   | ..                        | <i>crudelis</i>      | Hedley. Type.                                |
| .. 134.   | ..                        | <i>darnleyi</i>      | Brazier. Darnley Island,<br>Queensland.      |
| .. 135.   | ..                        | <i>informis</i>      | Hedley. Type.                                |





*Phyllis T. Carter*

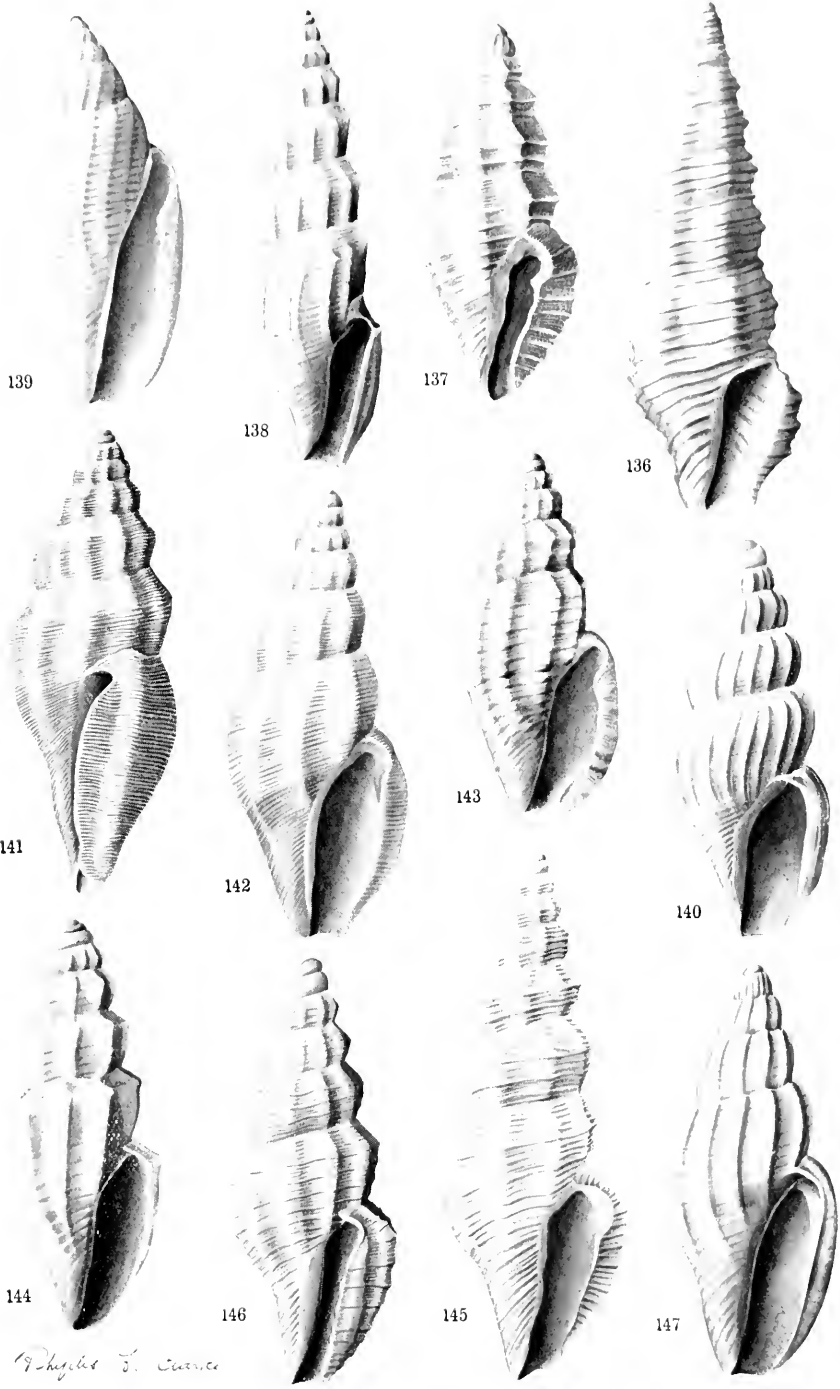




EXPLANATION OF PLATE LII.

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- Fig. 136. *Pseudorhopitoma styracina* Hedley. Type.  
 .. 137. .. *transitans* Hedley. Type.  
 .. 138. *Guraleus brazieri* Angas. Port Jackson.  
 .. 139. .. *complus* Adams and Angas. Port Jackson.  
 .. 140. .. *costatus* Hedley. Type.  
 .. 141. .. *fasciatus* Hedley. Type.  
 .. 142. .. *fasciatus* var. *stepheneensis* Hedley. Type.  
 .. 143. .. *glacoides* Pritchard and Gatliff. Bass Straits.  
 .. 144. .. *flurescens* Angas. Port Jackson.  
 .. 145. .. *lefourneauianus* Crosse and Fischer. Port Jackson.  
 .. 146. .. *morologus* Hedley. Type.  
 .. 147. .. *nitidus* Hedley. Type.



*Phyllis L. Cuvier*





EXPLANATION OF PLATE LIII.

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- Fig. 148. *Guraleus permutatus* Hedley. Type.
- .. 149. .. *pictus* Adams and Angas, var. *vincentinus* Crosse and Fischer. Port Stephens, N. S. Wales.
- .. 150. .. *pictus* var. *meredithae* Tenison-Woods. Port Jackson.
- .. 151. .. *tasmanicus* Tenison-Woods. Port Jackson.
- .. 152. .. *tenuiliratus* Angas. Port Jackson.
- .. 153. *Macteola anomala* Angas. Port Jackson.
- .. 154. .. .. Apex.
- .. 155. .. .. Detail of sculpture.
- .. 156. .. *segesta* Chenu, var. *cinctura* Hedley. Type.
- .. 157. *Daphnella botanica* Hedley. Type.
- .. 158. .. .. Apex.
- .. 159. .. .. Detail of sculpture.
- .. 160. .. *vestrum* Hedley. Type.
- .. 161. .. *chererti* Hedley. Type.
- .. 162. .. *granata* Hedley. Type.





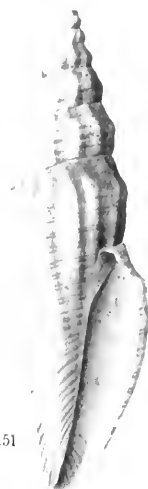
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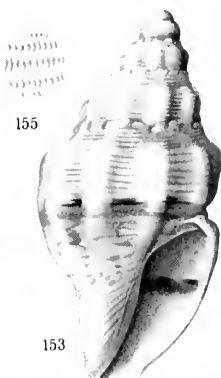
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151



152



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154



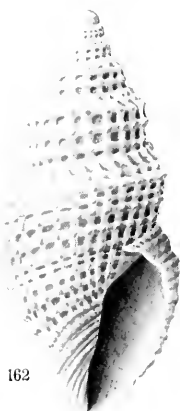
159



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*Phyllis T. Clark*





EXPLANATION OF PLATE LIV.

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- Fig. 163. *Daphnella signastoma* Hedley. Type.  
.. 164.        ..        Apex.  
.. 165. *Vepracula scula* Hedley. Type.  
.. 166.        ..   *racillata* Hedley. Type.  
.. 167.        ..   *racillata* var. *paucicostata* Hedley. Type.  
.. 168. *Hemidaphne cyclophora* Deshayes. Murray Island, Queensland.  
.. 169. *Nepotilla tropicalis* Hedley. Type.  
.. 170. *Asperdaphne alborincta* Angas. Port Jackson.  
.. 171.        ..   *amplecta* Hedley. Type.  
.. 172.        ..        Apex.  
.. 173.        ..   *capricornea* Hedley. Type.



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*Prigilis* T. Clark





EXPLANATION OF PLATE LV.

- |           |  |                                     |
|-----------|--|-------------------------------------|
| Fig. 174. | <i>Asperdaphne compacta</i> Hedley.      | Type.                               |
| .. 175.   | .. <i>reerei</i> Sowerby.                | Type.                               |
| .. 176.   | .. ..                                    | Detail of sculpture.                |
| .. 177.   | <i>Pseudodaphnella attenuata</i> Hedley. | Type.                               |
| .. 178.   | .. <i>bernardi</i> Brazier.              | Murray Island,<br>Queensland.       |
| .. 179.   | .. <i>canistra</i> Hedley.               | Type.                               |
| .. 180.   | .. <i>crassilirata</i> Hervier.          | Torres Straits.                     |
| .. 181.   | .. <i>harenula</i> Hedley.               | Type.                               |
| .. 182.   | .. <i>magnum</i> Hedley.                 | Type.                               |
| .. 183.   | .. <i>modesta</i> Angas.                 | Port Jackson.                       |
| .. 184.   | .. <i>oligoina</i> Hedley.               | Type.                               |
| .. 185.   | .. <i>philippinensis</i> Reeve.          | Apex, Murray<br>Island, Queensland. |
| .. 186.   | .. <i>panicca</i> Hedley.                | Type.                               |





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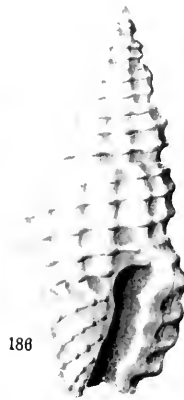
182



183



184



186

*Phyllis G. Clarke*

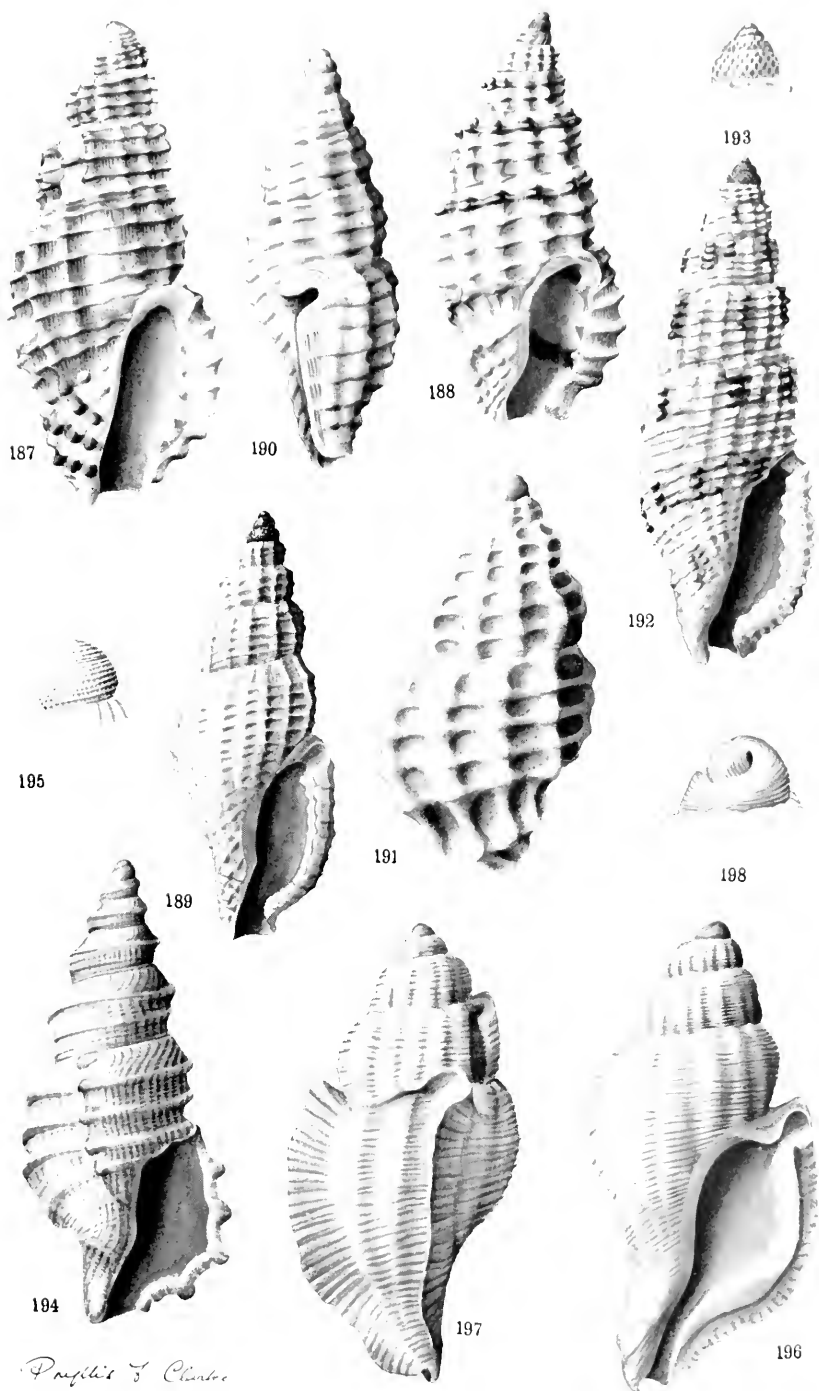




EXPLANATION OF PLATE LVI.

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- Fig. 187. *Pseudodaphnella pustulata* Angas. Port Jackson.
- .. 188. .. *ramsayi* Brazier. Type. The crooked spire of  
this specimen is an individual deformity.
- .. 189. .. *retellaria* Hedley. Type.
- .. 190. .. *rufizonata* Angas. Port Jackson.
- .. 191. .. *stipata* Hedley. Type.
- .. 192. .. *tessellata* Hinds. Murray Island, Queensland.
- .. 193. .. .. Apex.
- .. 194. *Eucyclotoma nobilis* Hedley. Type. Wreck Reef.
- .. 195. .. .. Apex. Murray Island, Queensland.
- .. 196. *Daphnellopsis murex* Hedley. Type.
- .. 197. .. ..
- .. 198. .. .. Apex.



*Prof. G. S. Cooper*



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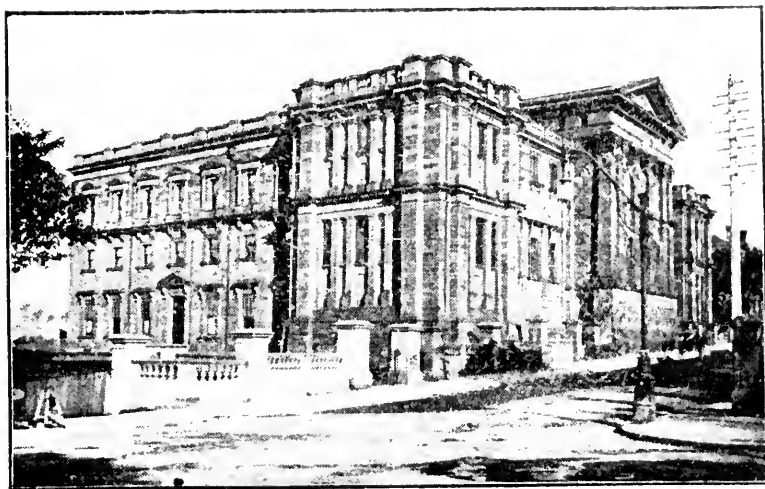
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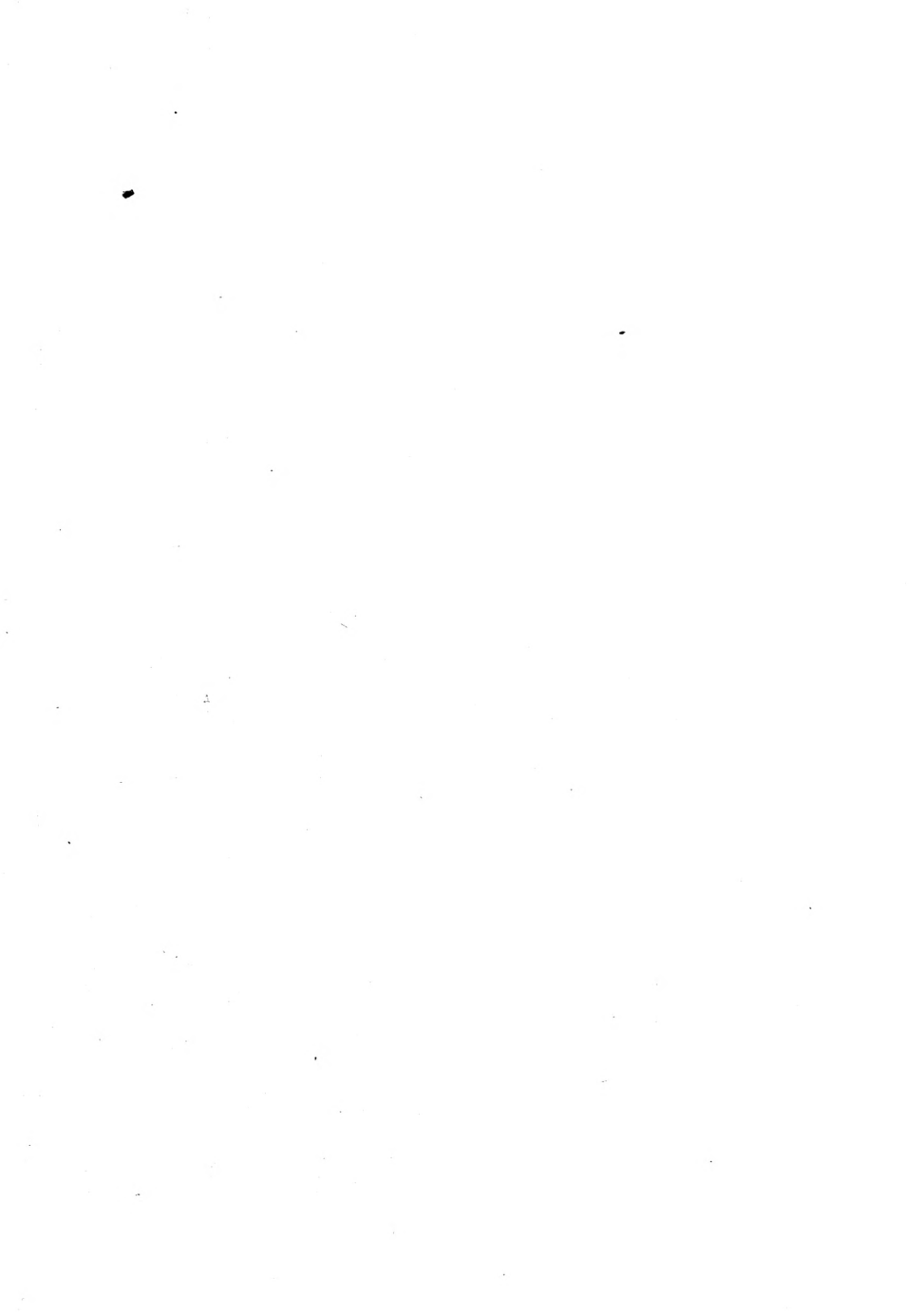
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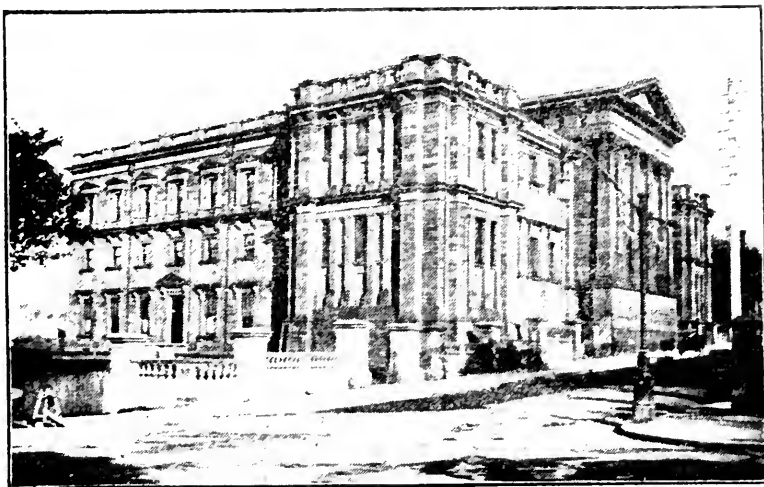




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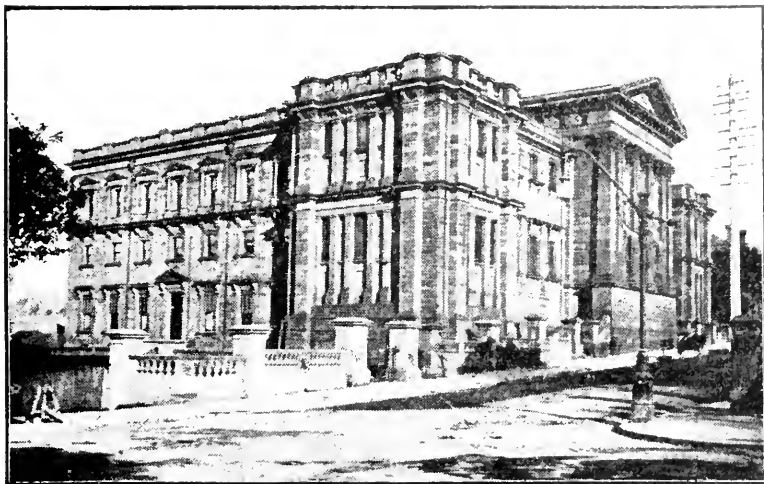




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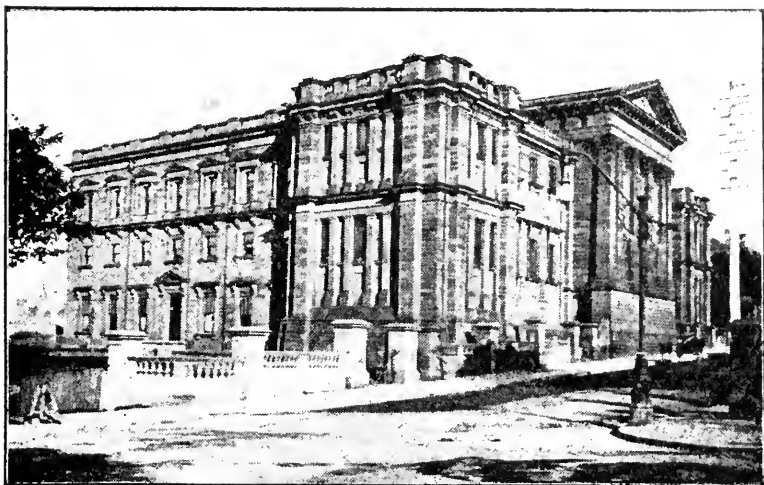




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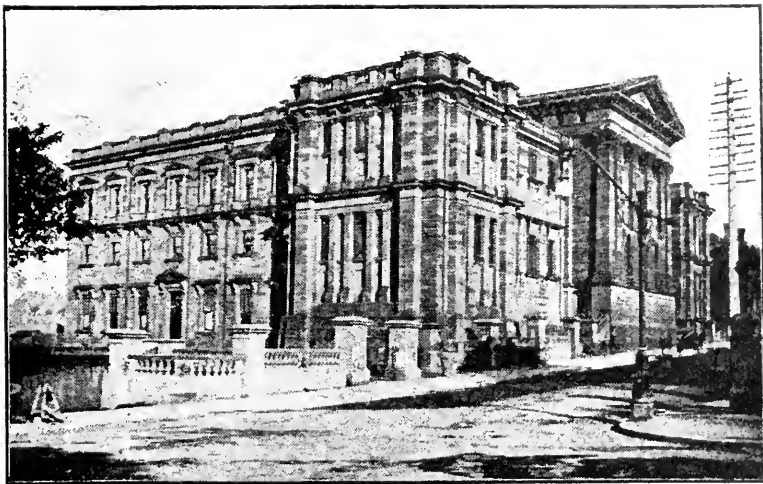
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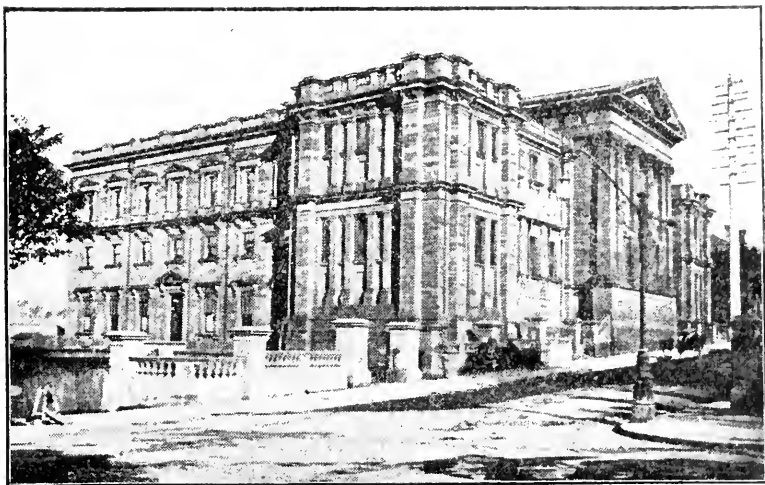




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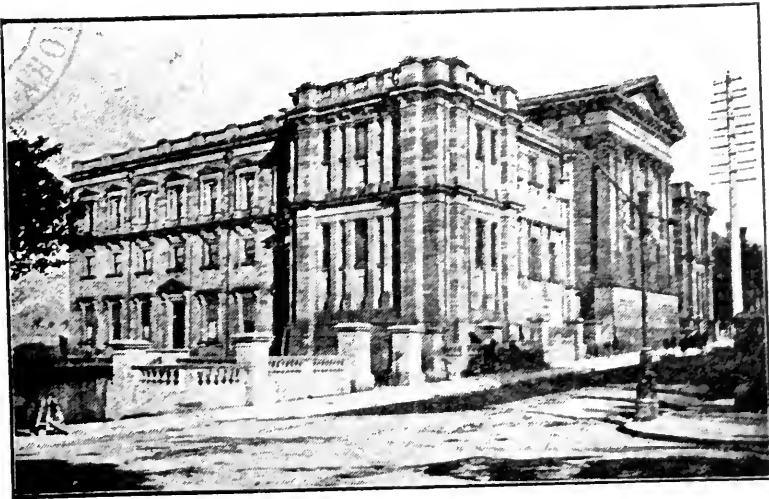




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